higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

A study undertaken for the Department of Higher Education and Training

Co-funded by the European Union

School Teacher Supply and Demand in South Africa in 2019 and Beyond

Servaas van der Berg
Martin Gustafsson
Cobus Burger

Research on Socio-Economic Policy (ReSEP)

UNIVERSITEIT iYUNIVESITHI STELLENBOSCH UNIVERSITY

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123 Francis Baard Street
Private Bag X174, Pretoria 0001
Telephone: 012 312 5911
Fax: 012 32 6770

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ABBREVIATIONS AND ACRONYMS

APP	Annual Performance Plan
BAU	Business as usual
BEd	Bachelor of Education degree
CAPS	Curriculum Assessment Policy Statements
CDE	Centre for Development and Enterprise
CPUT	Cape University of Technology
CUT	Central University of Technology
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DUT	Durban University of Technology
EC	Eastern Cape
FET	Further Education and Training
FS	Free State
FT	Full time
GDP	Gross domestic product
HEMIS	Higher Education Management Information Systems
ITE	Initial teacher education
KZN	KwaZulu-Natal
LE	Learner-educator ratio
LOLT	Language of learning and teaching
LP	Limpopo
LURITS	Learner Unit Record Information Tracking System
MP	Mpumalanga
NC	Northern Cape
NDP	National Development Plan
NMMU	Nelson Mandela Metropolitan University
NPC	National Planning Commission
NSC	National Senior Certificate
NSFAS	National Student Financial Aid Scheme
NW	North West
NWU	North West University
PERSAL	Personnel Administration and Salary System

PGCE	Post-graduate Certificate in Education
PT	Part-time
ReSEP	Research on S0cio-Economic Policy, University of Stellenbosch
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SA-SAMS	South African School Administration and Management System
SGB	School Governing Body
TIMSS	Trends in International Mathematics and Science Study
TUT	Tshwane University of Technology
TVET	technical and vocational education and training
UFH	University of Fort Hare
UFS	University of the Free State
UJ	University of Johannesburg
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UNESCO	United Nations Educational, Scientific and Cultural Organization
Unisa	University of South Africa
UNIVEN	University of Venda
UP	University of Pretoria
US	University of Stellenbosch
UWC	University of the Western Cape
UZ	University of Zululand
WC	Western Cape
Wits	University of the Witwatersrand
WSU	Walter Sisulu University

FOREWORD

This research report was produced for the Department of Higher Education and Training (DHET) and the Department of Basic Education (DBE). The study was undertaken to assess demand for, and supply of, teachers in the public service, in order to better inform teacher training policy.

The need for such analysis arose from the concern that not enough teachers are being trained to meet future needs. The 2011 *Integrated Strategic Planning Framework for Teacher Education and Development 2011-2025* (DBE & DHET) that flowed from the 2009 Teacher Summit declared adamantly that there was:

> *…both an absolute shortage of teachers, and a relative shortage of teachers qualified and competent enough to teach specific subjects or learning areas…, in specific phases…, in specific languages…, in Special Needs schools, in ECD, and in rural and remote schools.* (DBE & DHET, 2011, 11)

The focus of the current report is mainstream schooling, particularly public schools, looking at Grades 1 to 12. The primary emphasis is on publicly employed teachers; hence teachers in public schools who are privately employed are excluded from this part of the study. However, a secondary focus of the report is demand for teachers outside of the primary focus area, including for teachers in pre-Grade 1 education, teachers in independent schools (which may or may not be publicly funded), teachers in special needs education, as well as for privately paid teachers in public schools. The secondary focus areas may have to some extent different dynamics. Data for these areas is in a different form to data generated for the primary focus area. Hence it is not possible to integrate data derived from the main and secondary focus areas into the main analysis, or to arrive at a single series of conclusions.

Part 1 of this study focuses almost exclusively on teacher demand. **Part 2** focuses on teacher supply, and **Part 3** is a comparison of teacher supply and demand.

PART 1:

TEACHER DEMAND IN SOUTH AFRICA IN 2019 AND BEYOND

Martin Gustafsson

Part 1 Executive summary

Part 1 of this study focusses on predicting the future demand for educators, with breakdown in terms of school level and language and non-language subjects, where applicable. It is accompanied by a teacher demand model, with data provided in Excel spreadsheet form[1]. Issues which need to be understood to forecast teacher demand are explained, and analysis presented to support this perspective.

The report should be useful beyond the planning of teacher supply. In particular, the question of the relationship between learner-educator (LE) ratios and class sizes has been inadequately analysed in the past, yet it is important for the debates around educational quality improvements and the distribution of teachers.

A literature review (Section 2) confirms that even internationally, there is not much in the way of publicly available teacher demand (and supply) studies. Some of what exists is reviewed. Despite the existence of some South African studies, the current report would easily represent the most ambitious attempt to date to understand the dynamics of future teacher demand in South Africa.

Five inputs needed for the teacher demand model are each discussed in detail (Section 3). They are as follows:

1. School enrolments
2. Language of learning and teaching
3. Subject choices of learners
4. Learner-educator ratios
5. Attrition of teachers

For future school enrolments, an existing set of projections, produced in 2017, is used. Three projections are used for the teacher demand modelling, each of which has different assumptions relating to grade repetition and dropping out. Reducing levels of dropping out is high on the policy agenda in South Africa. While improving the quality of learning and teaching is also emphasised, and while this would have the effect of reducing grade repetition, the matter of reducing grade repetition levels is barely dealt with explicitly in the policy discourse. Grade repetition is hugely important for understanding teacher demand. Reducing grade repetition to lower yet plausible levels could reduce the annual demand for new teachers at the primary level by up to 15%. This needs to be seen against the fact that in an international comparison, South Africa's grade repetition levels are high. However, given that South Africa's classes are large, the optimal outcome of a reduction in grade repetition is almost certainly to reduce class sizes, as opposed to reducing teacher inflows.

The matter of language of learning and teaching (LOLT) is only really of concern for the teacher demand modelling in Grades 1 to 3. There need to be sufficient numbers of teachers able to use each the eleven official languages as their medium of instruction. The data for this is relatively straightforward to obtain.

The subject choices of learners occur in relation to the language subjects and, in Grades 10 to 12, in relation to non-language subjects. Choices around language are in part the choices of individual learners, especially at the secondary level, although often this is a matter of choice taken by a whole school. The matter of subjects is particularly complex at the secondary level, in Grades 8 to 12, because

1 Excel files e-mailed by Prof van der Berg to Dr Green, cc Michelle Mathey, on 15 June 2020.

teachers tend to teach just a few subjects each, and in Grades 10 to 12 learners have considerable scope to specialise in specific non-language subjects. In order to translate what learners study into teacher demand figures, it is necessary to analyse the implications of both policies and actual practices. Section 3.3 provides an analysis, using DBE microdata, of how teachers actually spread their time across grades (and even phases) and subjects. It also examines how one university arranges subject specialisation among those wanting to be secondary teachers. This analysis then informs the structure of the teacher demand model.

One thing that stands out with respect to subject choices is the very unequal access to more technical subjects among black students in Grades 10 to 12. For instance, the percentage of learners accessing the subject Computer Applications Technology is ten times higher among white learners than black African learners.

LE ratios are also a complex matter. While actual LE ratios are easy to obtain, what must be understood is the relationship between the ratio and class size at the level of the school. South Africa's class sizes are exceptionally large, according to international comparisons presented in Section 3.4. It is found that the worst cases of over-sized classes can be tackled through better utilisation of existing numbers of teachers. This is established in part by comparing the class sizes of schools with similar LE ratios. Inefficiencies in this regard tend to be province-specific. However, the international comparison suggests that over the longer term, South Africa should aim to lower its LE ratio, for instance from 33 to 28 in Grades 1 to 3.

The attrition of teachers is not easy to estimate, even in a historical sense. Churning, or repeated movements in and out of public employment of the same people, complicates the derivation and interpretation of attrition rates. Assumptions around pre-retirement attrition are unavoidably risky as teacher behaviour in this regard can easily change, for instance, as new opportunities in the rest of the labour market open up or old opportunities disappear. In comparison, future attrition due to retirement is relatively easy to forecast. Future attrition, whether from retirement or some other factor, is calculated using an existing 2012 teacher forecasting tool, which was updated to serve the needs of the current analysis.

It is not standard practice to consider the quality of teachers, as opposed to their quantity, within a teacher demand model. Yet the calibre and skills of people entering teaching are obviously important. The matter is discussed briefly at the start of Section 3. Though South African university students who intend becoming teachers tend to have rather low Grade 12 results relative to other university students, this is probably true across many countries. Schooling systems can simply not afford to pay the salaries found in other sectors and hence compete on an equal footing with, say, engineering, medicine or commerce. The little evidence that we have on the skills of young South African teachers relative to the skills of the population, in general, suggests that South Africa is not badly placed in an international comparison. The most sustainable way of improving teacher quality is to raise the general standard of performance in schools and access to post-school studies so that the pool of graduates from which the teaching profession draws is improved.

In introducing the reader to the demand model, Section 4 summarises the data and assumptions used for a 'business-as-usual' (BAU) scenario implemented in the Excel tool. This scenario is one of five scenarios developed for the report – these can be found in five Excel files[2]. Thereafter, a series of equations describing the model are presented and discussed. These equations can help the reader

2 The Excel files were shared e-mailed by Prof van der Berg to Dr Green, cc Michelle Mathey, on 15 June 2020.

understand the technical aspects of the model, but it is also possible to examine the Excel files directly. Nothing in these files is hidden or locked, and no background coding is used.

The essential outputs of the model are total teachers needed and new teachers, or joiners, needed in each year. Within the model, teachers are any publicly employed educators in public ordinary schools. Demand outside this scope is discussed in a separate section (Section 5). The demand figures are broken down, firstly, by four levels of the schooling system and, secondly, by language and subject, where applicable, although for the full range of language and subject breakdowns the reader would need to look at the Excel files.

The following table is a key one in the report. It assumes that the annual production of Grade 1 to 12 teachers would need to increase from a current level of around 30,540 to a level of 59,034 by 2030. This doubling in the number of joiners is driven to a large extent by the demographics of the teacher workforce. A bulge of older educators is reaching retirement, and as this bulge exits the system, an exceptionally large number of joiners is needed. The largest category within the Grades 1 to 12 group is the 'core', or publicly employed educators in public ordinary schools. This is 'Core BAU demand' in the table. The other four scenarios produce 2030 joiner values of between 43,000 and 53,000 for this 'core'. Key varying assumptions are the treatment of dropping out and grade repetition among learners, whether South Africa's learner-educator ratio at the primary level is reduced a little to bring it in line with international norms, and whether access among black learners to technology subjects, which require lower LE ratios, is increased.

Global teacher demand picture

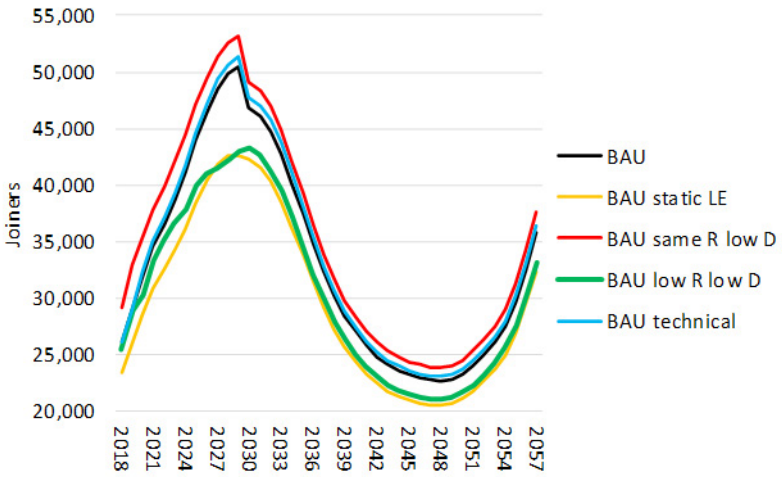
	Total 2018	Total 2030	Joiners 2019	Joiners 2030
Pre-Grade 1 education	128,021	143,646	8,730	17,195
Grade R in schools	20,878	20,878	1,211	2,310
Pre-school institutions	107,143	122,768	7,519	14,885
Grades 1 to 12	439,287	498,642	30,540	59,034
Independent schools	38,660	38,660	2,243	4,277
Privately paid teachers in public schools	29,000	29,000	1,683	3,209
Special needs education	9,972	9,972	579	1,103
Core BAU demand	361,655	421,010	26,035	50,445
Grand total	**567,308**	**642,288**	**39,270**	**76,229**

The increase in teacher demand at the pre-Grade 1 level is proportionally as large as the increase at the Grades 1 to 12 level. This reflects the National Development Plan (NDP) target of making access to two years before Grade 1 universal.

Very importantly, the large increase in the number of new teachers required would be followed by a period of decreasing demand, extending to around 2050. This can be seen in the following graph, which illustrates the five scenarios from the 'core' model. The post-2030 decline is due to the bulge of older educators having exited the system and a period of relatively low numbers of retirees. After about 2050, the demand for joiners would once again rise as a new bulge of educators who have now aged would

begin approaching retirement. This has large implications for universities training future teachers. While capacity needs to be expanded in the coming decade, beyond 2030 universities may in fact have excess training capacity, depending on how the pre-2030 expansion was managed.

Joiners in five scenarios



1 Introduction

A key purpose of this study is to provide an analysis of teacher demand which can inform the DHET's policy of the Department of Higher Education and Training (DHET) on the numbers of teachers for schools to be trained by universities in the coming years. More specifically, the current report is intended to inform the implementation of DHET's five-year statement on enrolment planning for universities, covering the financial years 2019/20 to 2024/25.

However, given that there is insufficient research into matters related to teacher demand in South Africa, the current analysis also intends to serve a higher purpose, *viz.* to improve the knowledge base determining policies on teachers.

Part 1 focuses almost exclusively on teacher demand. Part 2 focuses on teacher supply, and Part 3 compares teacher supply and demand.

Section 2 of Part 1 discusses calculations of teacher demand undertaken inside and outside South Africa.

Section 3 discusses five factors which are expected to influence future demand for teachers. Policies, strategies and socio-economic trends relating to each of the five factors are discussed. The data available to provide an understanding of these factors is introduced.

Section 4 presents the essential product of the report, including equations used to calculate future teacher demand. Accompanying this report is a set of five Excel files, where each file contains detailed demand figures, and reflects one of five scenarios.

Section 5 discusses teacher demand in non-core areas.

2 Literature review

2.1 What can we learn from studies undertaken outside South Africa?

There are surprisingly few generic guides for education planners on how to estimate the future demand for teachers. Williams (1979) provides useful guidance, although it is important to acknowledge that this was published some 40 years ago. He defines basic parameters for estimating demand and supply and differentiates between the stock and the flow of teachers, a distinction which is also made in Section 4 below.

Much of the guidance must be sought through reviewing actual teacher demand estimations produced beyond South Africa. In doing this review, there appeared to be three key questions. The first question is: What drives aggregate demand calculations? Is it hard class size norms, learner-educator norms, or available budgets? The second question relates to whether or not subject specialisations, particularly at secondary level, are considered. The third question is: How far into the future should demand projections extend?

There are not many easily available teacher supply and demand studies. One study was conducted by Bennell and Molwane (2007, p. 66) for Botswana, and it follows a fairly standard approach. Since Botswana has no specific policies for maximum class size and optimal LE ratios, assumptions regarding optimal figures drive calculations. Aggregate demand figures for primary and, separately, secondary

schools are calculated. No subject-specific demand calculations are presented. This is largely because the data required for this was not available.

One of the few studies which includes some consideration of subject-specific demand at secondary level is that by Singh and Han (2016), which focuses on the two Indian states of Karnataka and Madhya Pradesh. The methods they employ are unique and informed by the situations in the two states. Specifically, the policy emphasis is on ensuring that every secondary school has at least one teacher in each of five core subjects. Thus available data on teacher qualifications, teacher age and the schools where teachers are placed is used to identify, firstly, schools without specific specialist teachers and, secondly, when specialist teachers are expected to retire. This informs the calculation of new teachers required over the following ten years. What is noteworthy about this study is its emphasis on having at least one specialist in each school for each subject. This is clearly important. If five teachers in a school must teach Mathematics, then having just a single teacher with a Mathematics specialisation is still much better than having no teacher at all, as the one teacher can guide the other four teachers. This type of analysis could be valuable in the South African context. The study also draws on data obtained through visits to a sample of schools, in part to obtain information about what teachers actually teach. As is true for many schooling systems in developing countries, the two Indian states do not appear to have centrally warehoused data on what teachers teach.

2.2 Earlier work on teacher demand in South Africa

A 2001 teacher demand and supply study by Crouch (2001) has been influential. The study proposes a number of factors to be considered in arriving at demand figures. These factors are said to construct the demand picture 'from scratch' and cover matters such as grade repetition and substitute teachers. How all these factors come together in the report is unclear, since only final supply shortfalls are provided (the full details would be in Excel files which are not easily accessible).

A key argument made by Crouch (2001) is that South Africa would most probably face a major teacher shortfall, in part because of the AIDS pandemic. Why this shortfall did not materialise is an interesting question that easily warrants a research paper. One explanation is that teachers benefitted from the South African government's subsequent comprehensive provision of free antiretroviral treatment. However, other factors may also be important, including possible flaws in the original projections.

Arguably, the next major study of teacher supply and demand in South Africa is a report published by the Centre for Development and Enterprise (CDE) in 2015 (see Simkins, 2015). Calculations of the future total stock of teachers are straightforward and do not include a breakdown in terms of school subjects. Essentially, population trends and promotion rates in the schooling system are used to project enrolments. This is combined with existing learner-educator ratios to estimate demand. In other words, no major change to the learner-educator ratio was anticipated. What is more complex in this study is the calculation of the annual demand for new teachers and, specifically, calculation of annual teacher attrition. The report concludes that high levels of attrition among teachers is a key concern that needs to be addressed by employers. This finding was criticised in a DBE report, available on the DBE website, which argues that the CDE's estimates of teacher attrition were flawed, and that more reliable estimates pointed to teacher attrition in South Africa being relatively low when international comparisons were made (DBE, 2015b).

Three DHET researchers, Green, Adendorff and Mathebula (2014), published the report of a study which focused on the supply and demand of Foundation Phase (Grades R to 3) teachers. Enrolment projections and non-changing learner-educator ratios drive demand calculations extending to 2020.

A high expected growth rate in enrolments between 2009 and 2020 (22%) is, in part, attributable to increased participation in Grade R (Green, Adendorff & Mathebula, 2014, p. 10, p. 12.)

It appears no subject-specific demand calculations have been made previously for the secondary level, though Marchant and Lautenbach (2011) discuss the factors one would need to consider for this in the South African context. The current report is thus the first to attempt this work.

3 Key factors and policies shaping teacher demand

Five factors drive the demand for teachers, both the overall demand and demand specific to levels of the schooling system and subjects taught. The factors are:

1. School enrolments
2. Implemented language of learning and teaching (LOLT)
3. Subject choices of learners
4. Learner-educator (LE) ratios
5. Attrition of teachers

The five factors will be discussed in this order below. Each factor is driven by social trends and policies. Relevant policies are discussed fairly comprehensively, and a few points are made regarding social trends, which are obviously complex and can be examined in greater depth than is possible here. Key statistics are provided for each of the factors, and the sources for the statistics are discussed.

An important consideration not usually incorporated into teacher demand models is the demand for a *specific level of quality* of teachers. The schooling system needs a teacher in front of every class, but these teachers should be of a required standard in terms of their teaching skills. It is often argued that the teaching profession needs to attract young people who are higher up in the ability spectrum. This argument is often made, both in South Africa and in other countries. The problem with this argument, especially in a society such as South Africa's with serious educational backlogs and a general 'skills crisis' in the labour market, is that it assumes that young people who would otherwise become, say, engineers or university lecturers, would choose to become teachers instead.

Attracting more highly skilled people into teaching on a substantial scale would require paying teachers a great deal more than they are currently being paid. Yet South Africa's ratio of teacher pay to gross domestic product (GDP) per capita is, at 4.0, already high for a developing country (Gustafsson, 2018c). There is clearly not much room to raise teacher salaries substantially.

Part 2 of this report (teacher supply) provides new evidence that those training to become teachers at university have relatively low Grade 12 examination results. Such evidence is often raised as a concern. However, it is likely that this pattern is common across many countries. Few countries can afford to pay teachers what, for example, engineers would earn. Even if this were possible, it is likely to result in engineering firms increasing their pay even further in order to attract skilled people into engineering. Clearly, the overall skills constraint, in the form of learning outcomes obtained in schools and the percentage of the population who access university, places a limit on what can be done to get more skilled people into the teaching profession. The logical solution is to raise the general quality of learning outcomes. In this way, the quality of teachers *and* engineers could improve without raising salaries.

Where in the skills continuum of youths are young South African teachers situated? One way of calculating this is to find out how much more skilled the most skilled teachers are compared to the most skilled individuals in the general youth population. Background analysis undertaken for the current report[3] found the Grade 12 Mathematics scores of the 90th percentile of young teachers were 1.35 of a standard deviation higher than the score at the 90th percentile of youth in general. This value of 1.35 is higher than the best comparable values reported in developed countries. Unfortunately, figures for other middle-income countries could not be found. Nevertheless, these statistics suggest that the part of the skills pool from which teachers come is not that bad. The challenge lies in improving the skills of the entire skills pool.

3.1 School enrolments

Future school enrolments are driven by population trends, levels of entry into Grade 1, grade repetition and dropping out. An important policy imperative is the vision of the National Development Plan (NDP) that by 2030 all young South Africans should enjoy twelve years of education, which could be education from a school or from a TVET college. The NDP acknowledges that resource constraints may get in the way of realising this vision by 2030 (National Planning Commission (NPC), 2012, p. 295, p. 306). Policies on reducing grade repetition may also influence enrolments. Lower grade repetition brings about lower enrolments, especially over the longer term. There is no explicit policy on reducing grade repetition, although both the DBE's *2018/19 Annual Performance Plan* (DBE, 2018a) and the *Action Plan to 2014* refer to the need to reduce repetition (DBE, 2011, p. 85).
It should be noted that South Africa's grade repetition levels are high. Of 152 countries in the United Nations Educational, Scientific and Cultural Organization (UNESCO) database with figures on the percentage of Grade 1 learners who are repeaters for the years 2015 to 2019, South Africa's figure of 13% means that the country has the sixteenth highest repeater rate in the world. Of concern is the fact that countries which reported that less than 5% of Grade 1 learners were repeaters included Mozambique, Thailand, Indonesia, Kenya, Ghana and Philippines[4].

The teacher demand calculations draw on a set of enrolment projections produced in 2017 by the DBE in 2017 (DBE, 2017a)[5]. Those projections are relatively comprehensive and consider changing patterns of repetition and dropping out. The following four graphs illustrate three scenarios for public ordinary schools using the background Excel files of the 2017 report. 'BAU' stands for a business-as-usual approach where grade repetition and dropping out continue as for recent years. 'Same R low D' is a scenario where repeater levels remain the same, while dropping out is reduced and, within five years, eliminated. 'Low R low D' is a scenario where dropping out is eliminated in five years, and repetition is gradually reduced so that after five years it is only 2% in Grades 4 to 7, 5% in Grades 8 to 11 and 0% in all other grades. The scenario 'Low R low D' tends to lead to lower enrolment values in the long run, except for Grades 10 to 12, where the reduction in dropping out more than cancels out the effects of less repetition, resulting in higher enrolments, at least relative to BAU. The DBE report only projects enrolments to 2030. In the demand calculations presented in Section 5, enrolments as they were expected to be in 2030 were assumed to continue unchanged beyond that year.

3 Grade 12 Learners who Become Teachers: A Linking of Matric and PERSAL Data 2008-2017.

4 Indicator 'Percentage of repeaters in Grade 1 of primary education, both sexes (%)' on UIS.Stat. http://data.uis.unesco.org/

5 Background Excel files accompanying this report were used.

Figure 1: Enrolments Grades 1 to 3 until 2030

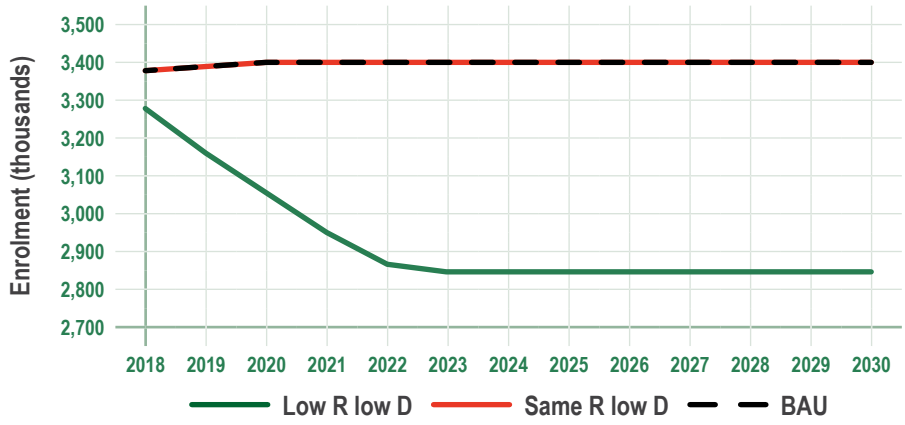


Figure 2: Enrolments Grades 4 to 7 until 2030

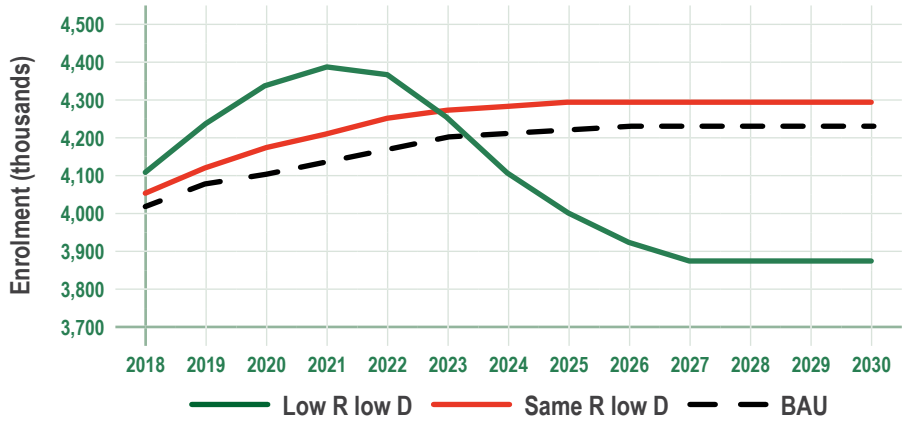


Figure 3: Enrolments Grades 8 to 9 until 2030

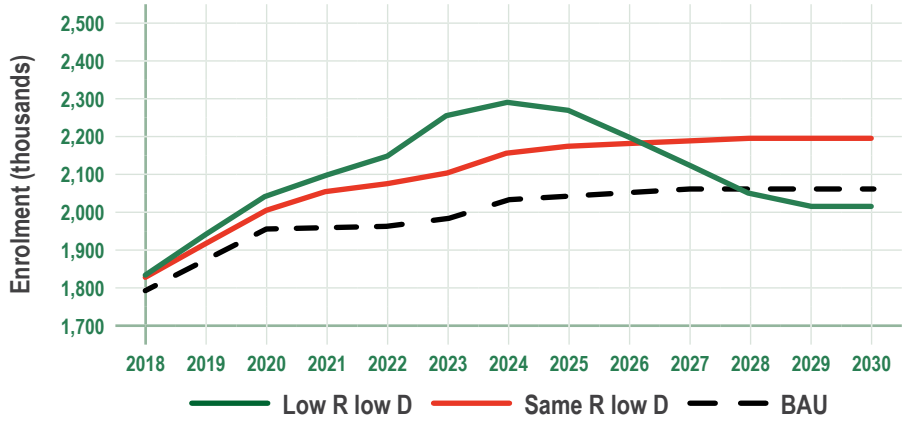
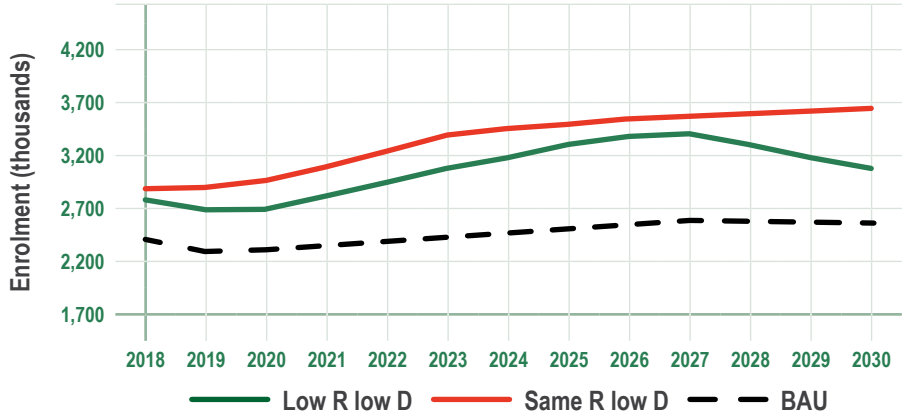
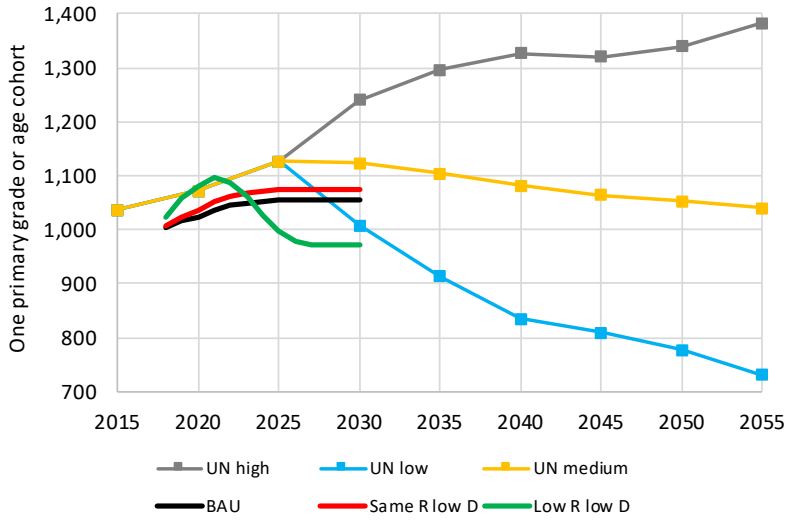


Figure 4: Enrolments Grades 10 to 12 until 2030



How do the future enrolment figures presented above compare to projections of the school-age population? Figure 5 below compares the enrolment projections discussed above to United Nations Population Division population projections for South Africa. The enrolment numbers reflected in the graph are Grades 4 to 7 totals divided by four, to give average enrolment in a grade. The UN figures are age 10 to 14 years divided by 5, giving the average size of an age cohort. Roughly, these enrolment and population figures should be similar. As shown in the graph, in fact they are. The three UN population scenarios serve as a reminder that teacher demand could vary enormously several decades into the future, depending on a variety of factors such as the number of births in the coming years.

Figure 5: UN population projections and expected enrolments



Source: UN figures are the UNPD's World Population Prospects, the 2017 revision, available at https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html.

3.2 Language of learning and teaching

In the Foundation Phase, parents decide what language or languages out of the eleven official languages will be taught to learners for the subjects 'Home Language' and 'First Additional Language'. The language

selected as home language is then used as the language of learning and teaching (LOLT), or medium of instruction for the remaining two Foundation Phase subjects, 'Mathematics' and 'Life Skills'. The home language thus becomes the LOLT. These arrangements are established by the 'CAPS'[6] policies, the South African Schools Act and the 'Language in education policy' of 1997 (Stein, 2017, p. 10). This means that teacher demand at this level is largely driven by the breakdown of home language *implementation* in schools. This is not the same as the breakdown of actual home language in the population. There are several reasons why the two may differ. Small language minorities within schools tend to be poorly catered for. More important is the fact that many public schools opt for English as home language even when learners speak another language at home. This can be seen in Table 1 below. The first column provides the breakdown of implemented home language, the second the breakdown of home language in the population. While only 6% of young children speak English as a home language, according to Stats SA, 23% of Grades 1 to 3 learners have English as their home language and LOLT at school. The data for implemented home language is not easily accessible. For this analysis, 2013 *Annual Survey of Schools* data was used. More recent *Annual Survey* data was compiled at national level, but has barely been used for any public reports, and may not be complete. However, it is unlikely that the situation has changed much since 2013. Between 1998 and 2007, patterns were roughly the same as the 2013 patterns according to the last detailed report available on LOLT (DBE, 2010, p. 14) and drawing on the *Annual Survey* data.

Table 1: Grades 1 to 3 languages

	% of Grades 1 to 3 learners with this LOLT	% of population aged 7 to 9 years with this home language
Afrikaans	9.0	9.2
English	23.1	6.3
isiNdebele	0.6	1.4
isiXhosa	16.6	19.4
isiZulu	20.6	28.0
Sepedi	9.3	9.8
Sesotho	5.7	7.8
Setswana	8.4	8.9
siSwati	1.7	2.8
Tshivenda	2.1	2.4
Xitsonga	3.1	4.1
Total	**100.0**	**100.0**

Sources: The first column is from own analysis of 2013 Annual Survey of Schools data (obtained from EMIS in DBE), using only records for public ordinary schools. The second column draws on the 2016 Community Survey data.

To better understand language demand in the Foundation Phase, it is useful to break the picture down by province. Table 2 uses data from 17,578 public ordinary schools with Grades 1 to 3 learners where both the implemented and actual home languages of learners were available in the 2013 Annual Survey data. To illustrate this, in the Eastern Cape, 10% of learners have English taught to them as their home

6 Curriculum and Assessment Policy Statements, available on the DBE website.

language, instead of isiXhosa (the fact that the two figures, 11% and minus 10%, do not add up exactly to zero is due to rounding). In other words, only 2% of children in the Eastern Cape have English as their actual home language (13% minus 11%), while 89% have isiXhosa as their actual home language (79% plus 10%). The only African language with positive values in the lower panel of Table 2 is Setswana in the North West. This is because learners in the North West whose actual language is another African language, in particular isiXhosa and Xitsonga, end up taking Setswana as a home language in school.

Table 2: Implemented against actual home language in Grades 1 to 3 (2013)

	EC	FS	GP	KZN	LP	MP	NC	NW	WC	SA
Percentage of learners per province with implemented home language										
Afrikaans	6	9	8	0	1	3	51	5	44	9
English	13	14	43	23	6	37	11	9	34	23
isiNdebele	0	0	0	0	0	6	0	0	0	1
isiXhosa	79	2	3	3	0	0	3	1	22	17
isiZulu	0	3	18	73	1	16	0	0	0	21
Sepedi	0	0	8	0	58	8	0	0	0	9
Sesotho	2	67	8	0	0	0	0	2	0	6
Setswana	0	5	9	0	1	2	34	82	0	8
siSwati	0	0	0	0	0	20	0	0	0	2
Tshivenda	0	0	0	0	16	0	0	0	0	2
Xitsonga	0	0	2	0	17	7	0	0	0	3
Total	100	100	100	100	100	100	100	100	100	100
Percentage point difference between implemented home language and actual home language										
Afrikaans	0	1	-1	0	0	0	-1	0	0	0
English	11	13	35	17	6	36	9	8	9	18
isiNdebele	0	0	-2	0	-1	-4	0	0	0	-1
isiXhosa	-10	-4	-5	-1	0	-1	-2	-3	-8	-4
isiZulu	0	-1	-9	-17	0	-9	0	-1	0	-6
Sepedi	0	0	-4	0	-1	-3	0	-2	0	-1
Sesotho	0	-8	-6	0	-1	-2	0	-2	0	-2
Setswana	0	0	-2	0	-1	0	-6	4	0	0
siSwati	0	0	-1	0	0	-13	0	0	0	-1
Tshivenda	0	0	-2	0	-1	0	0	0	0	0
Xitsonga	0	0	-4	0	-2	-5	0	-3	0	-1

Note: EC: Eastern Cape; FS: Free State; GP: Gauteng; KZN: KwaZulu-Natal; LP: Limpopo; MP: Mpumalanga; NC: Northern Cape; NW: North West; WC: Western Cape; SA: South Africa

The DHET's 2014 university enrolment plan stresses the importance of more speakers of the nine African languages entering the teaching profession, with a Foundation Phase focus (DHET, 2014, p. 7). This is in response to a clear under-supply of such teachers in recent years, a situation which makes mother-tongue instruction in initial grades difficult or impossible. Green, Adendorff and Mathebula (2014, p. 18) outline the severity of the problem. While isiXhosa-speakers should account for around 17% of new teachers entering the Foundation Phase, in 2012 they make up only 2%. Although less extreme, under-supply figures were found for all African languages other than isiZulu. Afrikaans- and isiZulu-speakers were over-represented, at least in percentage terms (though in absolute terms there was arguably not an over-supply in these two languages).

For grades above Grade 3, the situation is simpler. In these grades, the LOLT is either English or Afrikaans. Very limited experimentation in the use of African languages as a LOLT has occurred, although such experimentation is not driven by any explicit policy to expand post-Grade 3 LOLTs beyond English and Afrikaans. As shown in Part 2 of the current report, Afrikaans-speakers have been slightly over-represented in recent years among teachers entering the profession in public schools, yet these teachers are likely to be relatively proficient in English. There thus seems to be no problem relating to Afrikaans as a LOLT in Grades 4 to 12 which would necessitate bringing this into the modelling of future demand, and hence the calculations do not factor this in.

3.3 Subject choices of schools and learners

While Section 3.2 above dealt with the LOLT used to teach non-language subjects (and the related matter of the implemented home language in Grades 1 to 3), this section deals with the subjects, including language subjects, chosen by schools and learners in Grades 4 to 12. In Grades 4 to 9, this is a matter of the language subjects chosen, given that everyone takes the same non-language subjects. In Grades 10 to 12, a complex system of non-language subject choices is found. The policy parameters for all this are described in the Curriculum Assessment Policy Statements (CAPS).

Section 3.3.1 below outlines the patterns of participation in language and non-language subjects. Section 3.3.2 describes the national policy on the subjects which Grade 8 to 12 teachers must specialise in during their initial training. Section 3.3.3 describes how one university, the University of Pretoria, implements national policy through its curriculum design. Although implementation at only one university is described, it may help to concretise the notion of the subject combinations future teachers are likely to have. Finally, Section 3.3.4 uses DBE data to illustrate the extent to which schools get teachers to teach several grades and few subjects, as opposed to all or most subjects and just one grade. This has implications for the design of the demand model explained in Section 4.

Crucially, participation in subjects by learners informs the subject-specific demand in the model described in Section 4.2. There are two other ways of doing this. In the first, one could examine the subject specialisations of teachers, and their ages, and estimate the attrition and retirement of subject-specific categories of teachers. One problem with this approach is conceptual, in that it does not take into account the fact that when someone trained to teach Mathematics and Life Sciences, but who actually teaches Physical Science, leaves the system, the demand is actually for a Physical Sciences teacher, not a Mathematics or Life Sciences teacher. This approach is not invalid, but ideally it should estimate likely errors by examining the extent to which existing teachers are teaching the subjects they were trained to teach. The second approach would be to determine what teachers actually teach, and then to let the departure of teachers viewed in this way inform the estimated demand. This would be ideal. The problem is that the data needed for these alternative approaches does not really exist. Data on what subjects teachers are qualified to teach has been captured on the DBE's personnel

administration and salary (PERSAL) payroll system, but this is very incomplete[7]. Fewer than one-fifth of teachers have the required data. Data on what subjects teachers actually teach has in the past been captured through the *Annual Survey of Schools*, and is still, in theory, captured through the South African School Administration and Management System (SA-SAMS). However, data that schools enter through SA-SAMS is available only to a limited degree within a national database known as the Learner Unit Record Information Tracking System (LURITS). The subjects taught data, insofar as it exists, is housed in provincial data warehouses (National Treasury, 2017). PERSAL is also set up to capture subjects taught, but like the formal subject specialisation data in PERSAL, this has been poorly captured and is said to not yet be usable.

One important policy must be mentioned, although it is not taken into account explicitly in the model. This is 'The incremental introduction of African languages in South African schools' proposal of 2013 (DBE, 2013). This policy proposal envisages, among other things, that all learners should be exposed to the study of an indigenous African language, including the approximately 16% of learners whose home language is English or Afrikaans. Since exact rules for implementing this policy have not yet been specified, and because universities appear to increasingly require all future teachers to have some knowledge of at least one indigenous African language[8], there is no specific provision for this in the model. It seems possible that this policy can be accommodated without major additional changes to the system of teacher supply.

3.3.1 Patterns of language and non-language subject participation

The language and non-language subjects taken by learners must occur within parameters laid down by the CAPS. However, within these parameters there is room for much variation across schools. This variation receives attention below. Current variations, for instance by poverty quintile, as well as changes over time, have serious implications for how one understands inequalities in the schooling system and the changes needed in subject participation ratios in future years. Variations in participation ratios across schools are, in a narrow sense, driven by school level decisions, which are in turn permitted by the South African Schools Act[9]. However, more broadly, the apartheid legacy assumptions regarding what girls and boys should study and the capacity of schools to understand the value of specific subjects as well as the perceived ability of schools to secure the right subject-specific teachers influence the patterns described below.

There is little explicit policy on how subject participation in Grades 10 to 12, where the critical non-language variations are found, should change in the coming years. Perhaps the strongest policy signal is government's emphasis on improving performance in Mathematics and Physical Science in the final grades (Department of Planning, Monitoring and Evaluation (DPME), 2016). However, how this impacts on participation is ambiguous. One could argue that *lower* participation could reduce class sizes and therefore assist in sufficient individualised attention for high-ability learners, or one could argue that *higher* participation is necessary to increase the probability that more learners will reach key mark thresholds such as 50%. There is, moreover, an explicit interest in increasing access, particularly among black learners, to technical subjects such as Engineering Graphics and Design to improve the

7 This is described in an internal DBE report titled *How Good is the PERSAL Data on Teacher Subject Specialisation?*

8 For instance, the BEd programme at University of Pretoria requires all teachers to take modules in an African language – see https://www.up.ac.za/en/yearbooks/2018/pdf/programme/09133011 [accessed October 2018].

9 South African Schools Act, No 84 of 1996, https://www.education.gov.za/LinkClick.aspx?fileticket=aIolZ6UsZ5U%3d&tabid=185&portalid=0&mid=1828

opportunities of youth in the labour market (DBE, 2015a, p. 31). This policy signal has implications for participation ratios.

Grades 4 to 7 are easy to cover as what counts, above all, for teacher demand is participation in the various home language subjects. Table 3 below illustrates the situation in 2013, using the same Annual Survey data as that used in Section 2.2. This breakdown can be considered sufficiently representative of the situation in 2018. As explained in Section 3, the home language breakdown for Grades 4 to 7 is not as critical as the breakdown found in the Foundation Phase. In Grades 4 to 7, with very few exceptions, the LOLT is English or Afrikaans – 90% English and 10% Afrikaans, according to the *Annual Survey* data. In Grades 4 to 7, in other words, home language participation does not drive LOLT. As Afrikaans-speakers are over-represented by around 100% among young teachers who have joined the profession in recent years, it is assumed that the availability of teachers able to teach in Afrikaans is not a matter that needs to brought into the actual equations of the demand model.

Table 3: Home language in Grades 4 to 7

Language	Percentage of Grades 4 to 7 learners with this home language
Afrikaans	10.1
English	18.2
isiNdebele	0.7
isiXhosa	17.7
isiZulu	22.0
Sepedi	10.0
Sesotho	4.3
Setswana	9.0
siSwati	2.0
Tshivenda	2.4
Xitsonga	3.5
Total	**100.0**

Table 4 shows the home language situation in 2013 for Grades 8 and 9. What is noticeable is the lower figures for English for Grades 4 to 9, compared to the 23% for Grades 1 to 3 seen in Table 2. This should not be surprising. In Grades 1 to 3, parents and schools are likely to display an especially strong preference for English in order to avoid a LOLT switch between Grade 3 and Grade 4, a switch which is a reality for the great majority of South Africans and which has been widely debated (Taylor & Coetzee, 2013; Taylor & von Fintel, 2016)[10].

Table 4: Home language in Grades 8 to 9

Language	Percentage of Grades 4 to 7 learners with this home language
Afrikaans	9.7
English	15.0
isiNdebele	0.8
isiXhosa	16.3
isiZulu	22.6
Sepedi	12.4
Sesotho	5.1
Setswana	8.9
siSwati	2.1
Tshivenda	3.1
Xitsonga	4.1
Total	**100.0**

Turning to the far more complex situation in Grades 10 to 12, Table 5 shows percentages of full-time candidates in the 2017 Grade 12 examinations database by official language. In the case of the nine indigenous African languages, over 90% of candidates are taking the language at the home language level – if one excludes isiZulu, this becomes as high as 97%. Afrikaans and English are very different. Here only 35% and 16% respectively are taking the language as a home language. English is the only language offered in some form in all schools. The last column indicates the trend between 2010 and 2017 with respect to the percentage of public school learners taking the language. The largest change is in the case of Afrikaans, where participation dropped from 26.8% in 2010 to 22.7% in 2017 (a 4.1 percentage point drop). The breakdowns in Table 5 would to a very large extent also be seen in Grades 10 to 11, where learners are in many ways preparing for the Grade 12 examinations.

10 Taylor and Coetzee (2013) and Taylor and Von Fintel (2016) provide important empirical evidence showing that children learn best if they start off with a home language as a LOLT, and switch subsequently to English.

Table 5: Eleven official languages in Grade 12

Language	Percentage of all candidates in 2017	Percentage of public school candidates in 2017	Percentage in public schools taking this as home language	Percentage of public schools	Percentage point change 2010 to 2017 (public candidates)
Afrikaans	23.8	22.7	34.5	24.1	-4.1
English	100.0	100.0	15.2	100.0	0.0
isiNdebele	0.9	0.9	99.6	1.5	0.1
isiXhosa	15.0	15.0	97.9	18.4	1.5
isiZulu	27.8	28.4	91.7	34.4	2.4
Sepedi	12.6	12.9	99.5	20.6	0.0
Sesotho	5.1	5.2	98.8	8.1	-0.2
Setswana	7.5	7.7	99.8	9.9	0.2
siSwati	3.0	2.9	100.0	2.4	0.0
Tshivenda	3.0	3.1	99.8	4.0	-0.5
Xitsonga	4.2	4.3	99.9	6.1	-0.7

Sources: National Senior Certificate (NSC) microdata (report 343 format), with EMIS data used to determine whether a school is public.

Note: The first, second and fourth columns give percentages of the following: 629,927 candidates in total, 593,329 candidates in public schools, 6,095 public schools. The third column refers to the percentage of learners shown in the second column. The final column draws from 2010 NSC data, where there were 529,944 candidates in public schools. Throughout, only full-time examination candidates are counted.

For non-language Grades 10 to 12 (or the Further Education and Training (FET) band) subjects, the DBE website was accessed to check the correct names of subjects[11]. In the list in Table 6, four small subjects (marked with an asterisk) are in the 2017 examinations database but not in the DBE website list. Moreover, two subjects are only on the web page: 'Technical Mathematics' and 'Technical Sciences'. Three subjects with a superscripted 'T' in Table 6 are indicated as being 'Technical' in the web page list, as in 'Technical: Civil Technology'.

The largest change has been the 2010 to 2017 decline in Accounting, from 29.6% to 18.5%. This decline could be considered to be of concern, given the policy emphasis on greater labour market readiness among youth and a strong interest in promoting entrepreneurship skills. The Accounting decline seems to be across the board and not specific to any socio-economic level. The decline has been similar across the five poverty quintiles in which schools are placed, for instance.

11 https://www.education.gov.za/Curriculum/CurriculumAssessmentPolicyStatements(CAPS)/CAPSFET.aspx, with heading 'Nonlanguages in English', accessed August 2018. In a couple of cases, the subject name on the web page list differs slightly from what is in the curriculum document. In such cases the latter was used.

Table 6: Non-language subjects in Grade 12

Subjects (32)	Percentage of all candidates in 2017	Percentage of public school candidates in 2017	Percentage of public schools	Percentage point change 2010 to 2017 (public candidates)
Accounting	18.5	18.5	77.0	-11.1
Agricultural Management Practices	0.4	0.4	1.2	0.2
Agricultural Sciences	17.3	17.7	39.9	1.5
Agricultural Technology	0.1	0.2	0.7	0.1
Business Studies	35.8	35.2	82.3	-1.2
Civil Technology	1.5	1.5	7.4	-0.2
Computer Applications Technology	6.0	5.6	20.0	-3.0
Consumer Studies	6.7	6.7	19.8	0.5
Dance Studies	0.1	0.1	0.8	0.0
Design	0.4	0.3	2.1	-0.1
Dramatic Arts	1.5	1.5	5.4	0.4
Economics	23.0	23.0	69.5	-4.1
Electrical Technology	1.0	1.0	5.3	-0.1
Engineering Graphics and Design	4.8	4.8	13.6	0.0
Equine Studies*	0.0	0.0	0.0	0.0
Geography	48.7	49.1	80.8	10.4
History	25.3	25.4	53.6	8.9
Hospitality Studies	1.2	1.2	4.4	-0.7
Information Technology	0.7	0.6	4.5	-0.2
Life Orientation	100.0	100.0	100.0	0.0
Life Sciences	56.1	56.2	95.4	3.8
Maritime Economics*	0.1	0.1	0.3	0.1
Mathematical Literacy	56.1	56.2	90.2	4.5
Mathematics	43.9	43.8	96.2	-4.5
Mechanical Technology	1.1	1.2	4.8	-0.1
Music	0.3	0.3	3.3	0.0
Nautical Science*	0.0	0.0	0.1	0.0
Physical Sciences	31.5	31.4	88.6	-6.2
Religion Studies	1.4	1.3	1.4	0.9
Sport and Exercise Science*	0.0	0.0	0.1	0.0

Subjects (32)	Percentage of all candidates in 2017	Percentage of public school candidates in 2017	Percentage of public schools	Percentage point change 2010 to 2017 (public candidates)
Tourism	22.4	21.9	41.2	7.6
Visual Arts	1.0	1.0	5.6	-0.2

Note: The same denominators referred to in the note for Table 5 apply here.

The twelve non-official languages taken for the 2017 examinations are listed in Table 7 below. Candidate numbers are remarkably, and probably worryingly, low. Virtually all candidates are *not* taking the language as a home language.

Table 7: Non-official languages in Grade 12

Languages (12)	All candidates in 2017	Public school candidates in 2017	Public schools	Change 2010 to 2017 (public candidates)
Arabic	476	6	6	2
Chinese	10	10	8	-14
French	541	372	55	-32
German	444	435	47	-102
Gujarati	2	1	1	0
Hebrew	19	0	0	0
Hindi	57	55	14	21
Italian	7	7	4	-7
Portuguese	141	24	11	-6
Spanish	4	3	3	-1
Tamil	11	8	6	2
Urdu	40	28	10	27

Note: Given the small numbers, this table shows numbers of candidates, not percentages.

Table 8 reflects important information regarding current inequalities by quintile (all the tables and maps in the remainder of this section draw on the 2017 examinations data). Values highlighted in bold indicate that the quintile-specific percentage is less than half of the national ('Total') figure. Low participation among more disadvantaged learners with respect to key technical and vocational subjects is clear. The situation for Engineering Graphics and Design is striking. This subject is considered the core subject for a technical orientation in a school. Similarly, participation in Computer Applications Technology is heavily skewed in favour of the advantaged. The same can be said of Information Technology, a subject very similar to Computer Assisted Technology but less demanding. A subject skewed heavily in favour of less advantaged learners is Agricultural Sciences. What appears encouraging is that participation in the two key subjects Mathematics and Physical Science is roughly equivalent across the five quintiles.

Table 8: Non-language subjects in Grade 12 by quintile

Subjects (32)	Q1	Q2	Q3	Q4	Q5	Total
Accounting	18.9	18.2	18.0	17.0	20.2	**18.5**
Agricultural Management Practices	0.7	0.2	0.3	0.7	0.3	**0.4**
Agricultural Sciences	30.1	25.5	15.5	3.9	1.3	**17.7**
Agricultural Technology	0.2	0.0	0.0	0.3	0.3	**0.2**
Business Studies	30.9	31.8	33.2	42.6	45.0	**35.2**
Civil Technology	0.5	0.7	1.1	3.2	4.0	**1.5**
Computer Applications Technology	1.5	1.9	3.0	9.7	19.0	**5.6**
Consumer Studies	3.7	5.0	6.2	9.7	12.7	**6.7**
Dance Studies	0.0	0.1	0.0	0.1	0.3	**0.1**
Design	0.0	0.0	0.1	0.4	1.6	**0.3**
Dramatic Arts	0.5	1.0	1.2	2.0	3.9	**1.5**
Economics	26.3	26.2	24.8	20.2	11.8	**23.0**
Electrical Technology	0.6	0.9	1.0	1.9	1.5	**1.0**
Engineering Graphics and Design	1.3	2.1	3.2	8.5	14.6	**4.8**
Equine Studies*						
Geography	51.6	53.3	53.8	46.1	33.0	**49.1**
History	22.5	24.6	29.1	28.8	21.5	**25.4**
Hospitality Studies	0.2	0.8	0.5	1.9	3.9	**1.2**
Information Technology	0.1	0.1	0.3	0.8	2.9	**0.6**
Life Orientation	100.0	100.0	100.0	100.0	100.0	**100.0**
Life Sciences	62.7	59.8	54.1	49.9	49.4	**56.2**
Maritime Economics*	0.0	0.0	0.1	0.2	0.1	**0.1**
Mathematical Literacy	53.1	55.8	58.0	61.1	54.7	**56.2**
Mathematics	46.9	44.2	42.0	38.9	45.3	**43.8**
Mechanical Technology	0.3	0.6	0.9	2.7	2.5	**1.2**
Music	0.2	0.1	0.2	0.3	1.0	**0.3**
Nautical Science*	0.0	0.0	0.0	0.0	0.0	**0.0**
Physical Sciences	34.2	32.2	30.3	29.1	30.0	**31.4**
Religion Studies	2.9	0.3	1.0	1.1	1.1	**1.3**
Sport and Exercise Science*	0.0	0.0	0.0	0.0	0.0	**0.0**
Tourism	21.2	21.4	23.8	25.5	17.4	**21.9**
Visual Arts	0.3	0.2	0.5	0.9	4.4	**1.0**

Note: The denominators for the five quintiles, from 1 to 5, are: 134,243; 139,905; 158,976; 70,734; and 89,042.

Table 9 displays inequalities by population group and gender. It is noteworthy that few learners who are not black African take Agricultural Sciences. Coloured participation in Mathematics and Physical Science is particularly low, unlike the participation of the other three population groups. The low participation of black African learners in Computer Applications Technology and the four technology subjects – Engineering Graphics and Design and the three subjects marked with 'T' – stands out. *This seems easily the most concerning of all the trends examined in this section.* While female participation in Computer Applications Technology is not too worrying, female participation in the four technology subjects is clearly low.

Table 9: Non-language subjects in Grade 12 by population group and gender

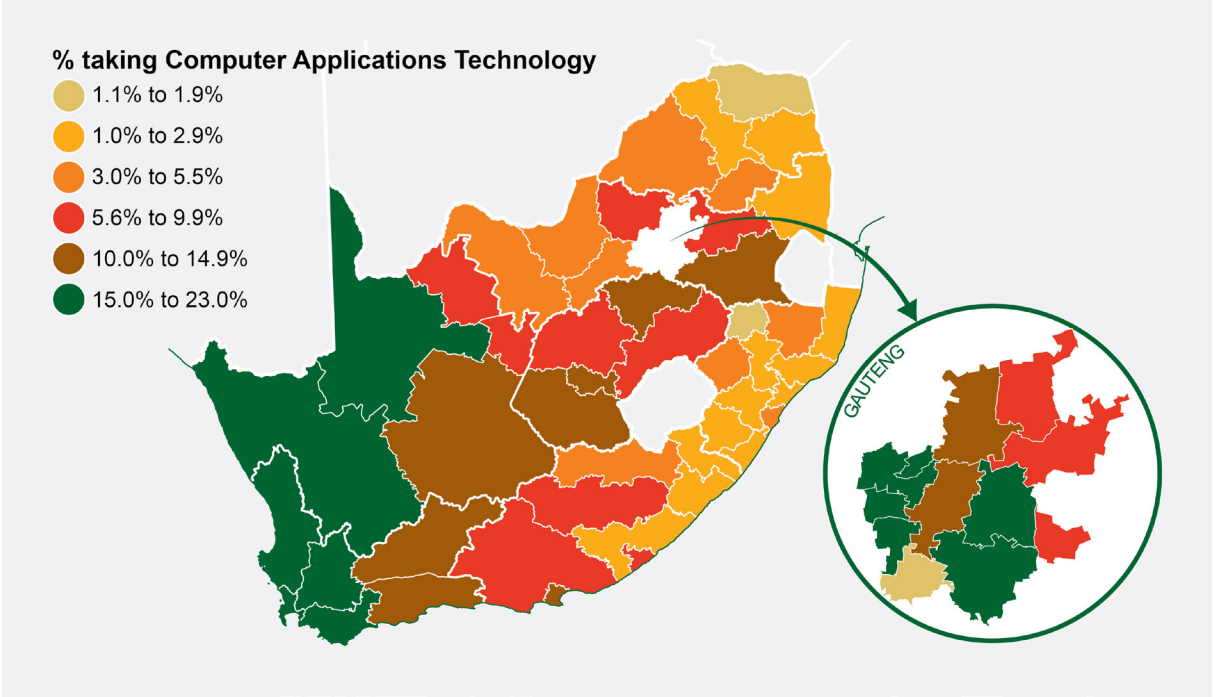
Subjects (32)	African	Coloured	Indian	White	Female	Male	Total
Accounting	18.7	13.1	28.3	19.1	22.3	17.3	**18.5**
Agricultural Management Practices	0.4	0.2	0.0	1.3	0.4	0.5	**0.4**
Agricultural Sciences	20.3	0.7	0.1	1.9	18.1	18.7	**17.7**
Agricultural Technology	0.1	0.1	0.0	1.2	0.1	0.3	**0.2**
Business Studies	34.3	47.2	44.8	32.5	39.6	34.9	**35.2**
Civil Technology	1.0	4.9	2.8	6.0	0.8	2.6	**1.5**
Computer Applications Technology	3.3	15.4	7.5	31.5	5.3	6.3	**5.6**
Consumer Studies	5.3	17.1	6.5	16.5	7.9	5.5	**6.7**
Dance Studies	0.0	0.5	0.0	0.3	0.1	0.0	**0.1**
Design	0.2	0.8	0.6	2.5	0.4	0.3	**0.3**
Dramatic Arts	1.3	1.1	3.3	4.1	1.7	1.2	**1.5**
Economics	24.9	14.6	8.6	6.5	26.4	22.5	**23.0**
Electrical Technology	1.0	1.0	0.8	2.1	0.6	1.6	**1.0**
Engineering Graphics and Design	3.4	5.6	13.3	26.0	2.5	7.8	**4.8**
Equine Studies*							
Geography	51.4	42.4	38.6	23.0	50.5	53.5	**49.1**
History	25.3	38.1	16.0	11.6	25.3	27.1	**25.4**
Hospitality Studies	0.8	1.4	3.2	7.2	1.4	0.9	**1.2**
Information Technology	0.3	0.7	6.5	5.2	0.3	1.0	**0.6**
Life Orientation	100.0	100.0	100.0	100.0	100.1	100.1	**100.0**
Life Sciences	57.5	50.9	60.0	40.3	62.8	57.7	**56.2**
Maritime Economics*	0.1	0.0	0.0	0.0	0.1	0.1	**0.1**

Subjects (32)	African	Coloured	Indian	White	Female	Male	Total
Mathematical Literacy	55.0	77.8	43.9	51.7	59.1	59.8	**56.2**
Mathematics	45.0	22.2	56.1	48.2	49.8	47.5	**43.8**
Mechanical Technology	0.9	1.8	2.8	3.7	0.5	2.0	**1.2**
Music	0.2	0.6	1.2	1.4	0.3	0.3	**0.3**
Nautical Science*	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Physical Sciences	32.5	15.3	38.3	33.3	34.7	35.1	**31.4**
Religion Studies	1.4	1.5	0.2	0.3	1.3	1.3	**1.3**
Sport and Exercise Science*	0.0	0.0	0.0	0.1	0.0	0.0	**0.0**
Tourism	22.0	24.0	15.8	18.3	21.9	22.4	**21.9**
Visual Arts	0.5	1.8	3.8	7.0	1.0	1.0	**1.0**

Note: The denominators for the four population groups are: 512,564 (black African); 40,678 (coloured); 9,596 (Indian); 30,070 (white). The denominators by gender are 327,673 (female) and 265,235 (male).

The maps shown in Figure 6 to Figure 10 illustrate participation across districts in subjects where there are noteworthy inequalities. In all the maps, a shade of green means that the district is at least at the level of the national mean (the second column of Table 6). The particularly low level of participation in Computer Applications Technology in Limpopo in Figure 6 and Figure 7 stands out. Figure 8 suggests that the under-serving of black African learners when it comes to Engineering Graphics and Design is especially striking in urban and more industrial districts, where employers would be particularly interested in youth with technical skills: there were only 273 black African candidates in this subject in Johannesburg West (JW – this education district includes parts of Soweto, and has 26,000 black African candidates), and Metro South in the Western Cape (MS – in this education district, which includes Khayelitsha, only 267 of 19,000 black African learners took this subject). Participation in Nelson Mandela Bay (Port Elizabeth) was also very low, and far lower than one would expect for such an industrialised part of the country.

Figure 6: Computer Applications Technology participation



Note: The maps all use 2017 National Senior Certificate (NSC) data and record only full-time learners in public schools. Districts are those reported in the official 2017 NSC report. Codes are explained in Table 1 in Appendix 1.

Figure 7: Computer Applications Technology participation (black African)

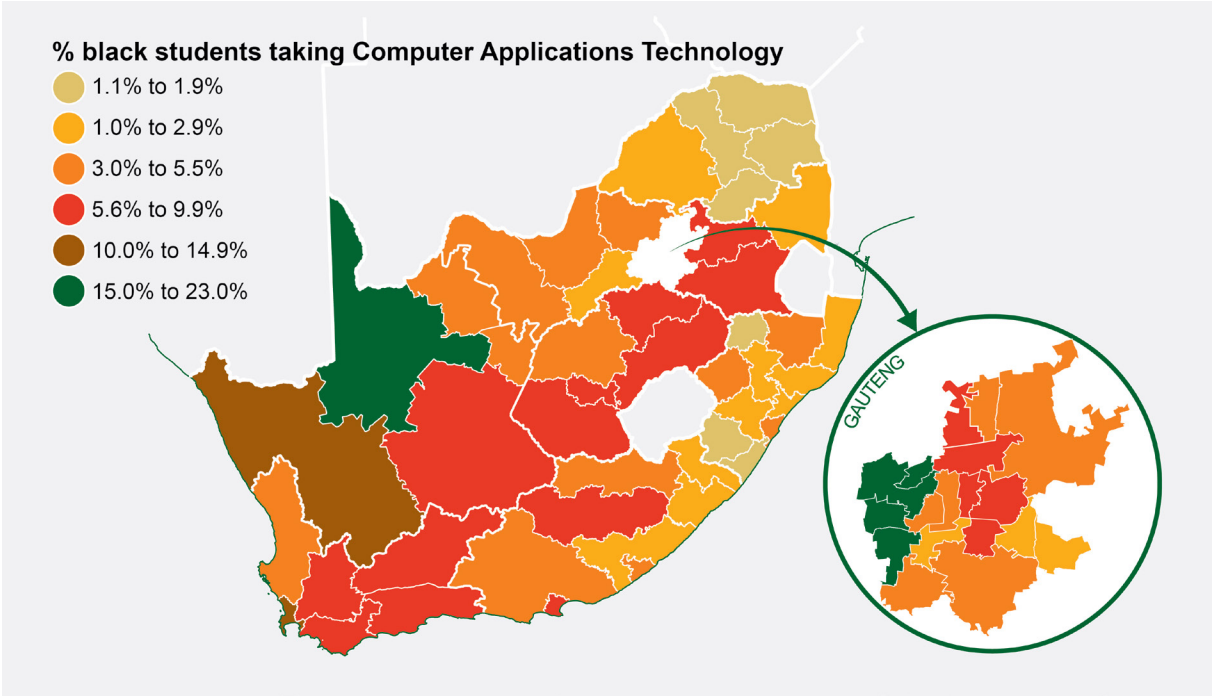


Figure 8: Engineering Graphics and Design participation

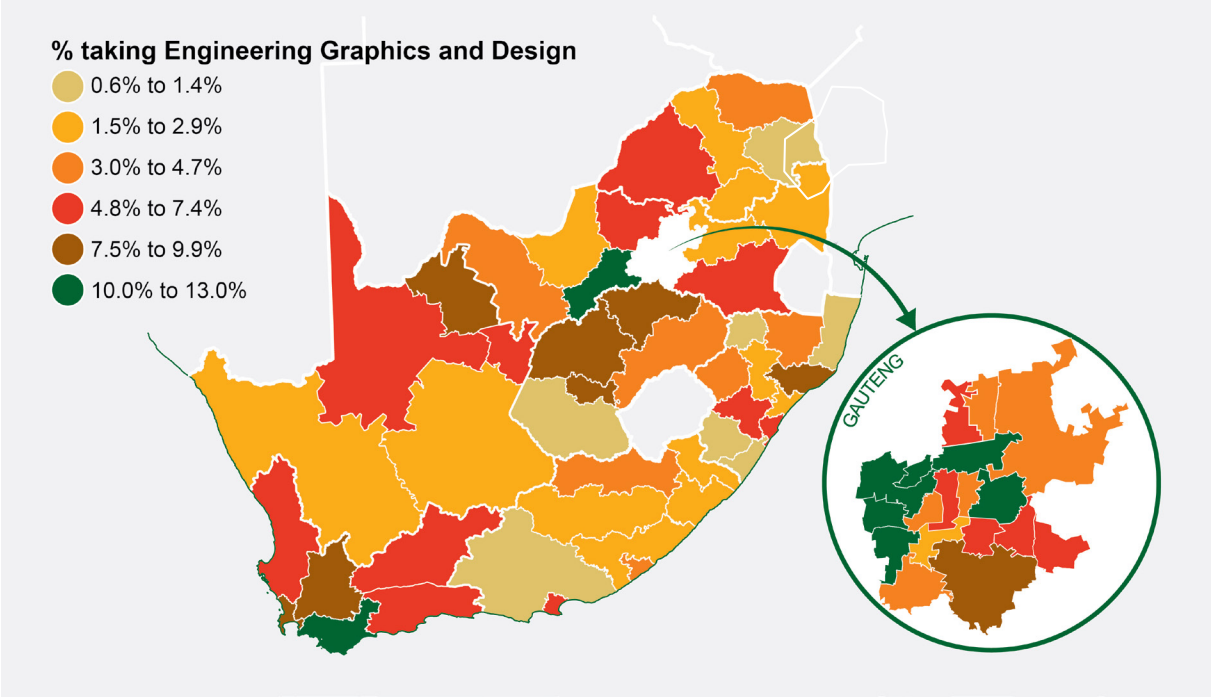
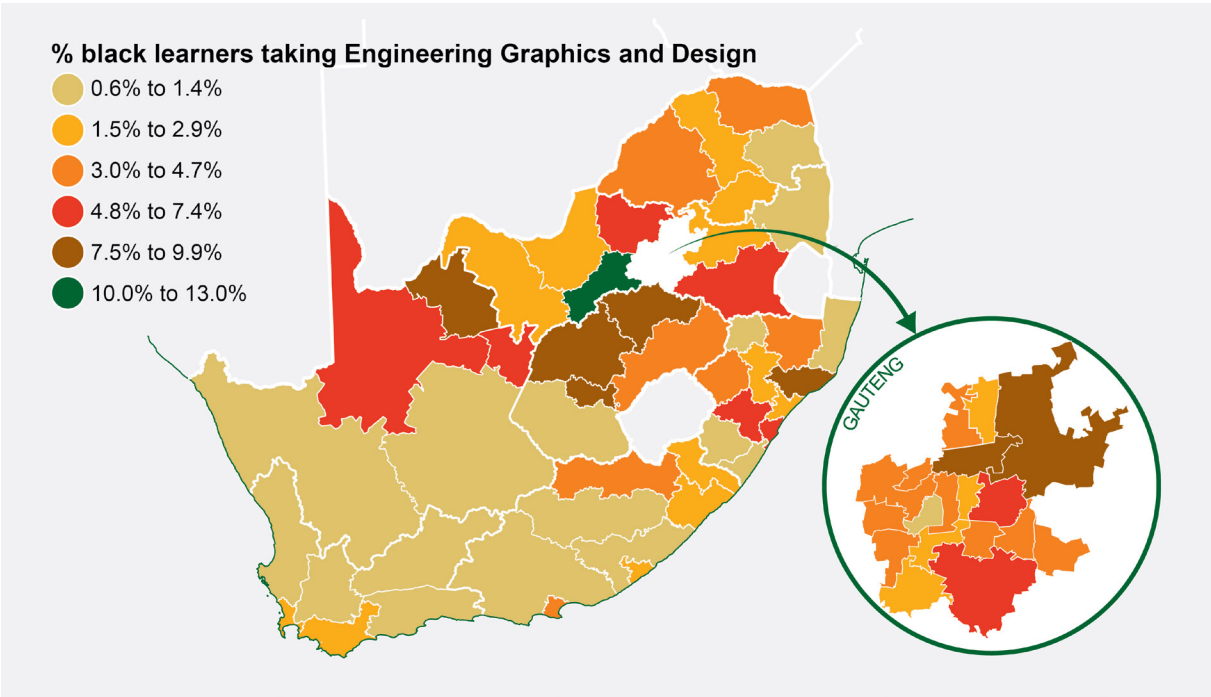


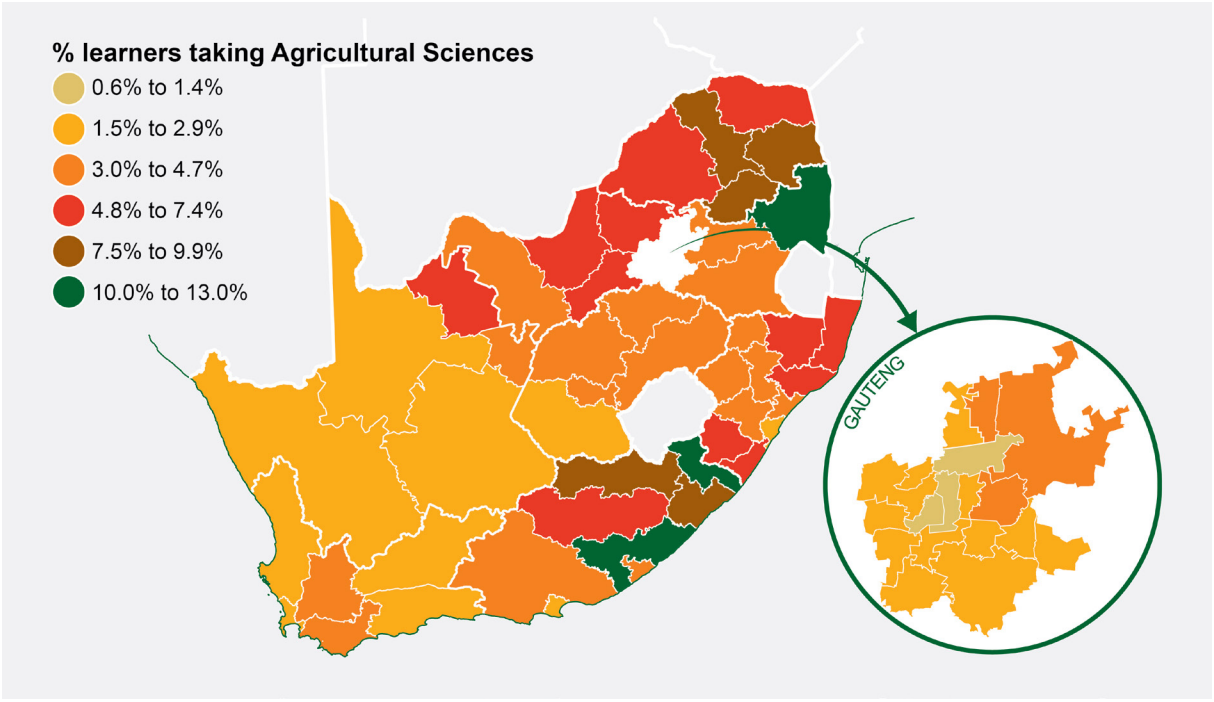
Figure 9: Engineering Graphics and Design participation (black African)



Participation in Agricultural Sciences seems to follow a logical geographical pattern, as shown in Figure 10. Participation in urban areas is low, but high in many rural areas. However, there are problems which are highly relevant given the current policy emphasis on greater black participation in the management of agriculture. Despite the fact that nationally only 2% of white learners participate in Agricultural Sciences, in eleven largely rural districts, white learners have a higher probability of participating in this

subject than black learners do (here 'black' means black African plus coloured). The eleven districts include Cape Winelands (CW), Eden and Central Karoo (ED), West Coast (WC), Gauteng West (GW), Lejweleputswa (LP), Xhariep (XH), Pixley ka Seme (PS), and ZF Mgcawu (ZM).

Figure 10: Agricultural Sciences participation



3.3.2 National policy on teacher specialisation

An important complicating factor is the fact that prospective teachers are entitled to focus on more than one subject when they study at university. An illustrative example reveals the complexity of the issue. If there is a demand for 1,000 English teachers and 1,000 Mathematics teachers at the FET level, meaning a total of 2,000 teachers, and there are 1,000 teachers who will graduate with *both* subjects as their specialisation, then there is a shortfall of 1,000 teachers. But how does one define this shortfall? Are universities training too few English teachers or too few Mathematics teachers? One way of answering the question is to assume that half of the 1,000 teachers will teach English and half Mathematics. That would result in a shortfall of 500 in each subject. However, circumstances in schools, such as prioritisation of Mathematics or incentives for Mathematics teachers, could result in a situation where *all* the available graduates teach Mathematics. This suggests that there could be a shortfall of 1,000 English teachers, which means that universities should focus on increasing the number of students specialising in English. It is beyond the scope of this report to model how universities should optimally organise subject combinations. Such optimisation is rather different from the calculation of subject-specific demand in the schooling system and should be performed separately. Moreover, subject choices offered and possible are likely to play themselves out differently at different universities.

However, these matters are important enough to warrant a short description here of how universities currently organise subject combinations. The rules in this regard are spelt out in Section 12 of Government Notice 111 of 2015, *Revised policy on the minimum requirements for teacher education qualifications*[12].

12 https://www.dhet.gov.za/Teacher%20Education/National%20Qualifications%20Framework%20Act%2067_2008%20Revised%20Policy%20for%20Teacher%20Education%20Quilifications.pdf

Teachers are trained for one of three levels of the schooling system: Foundation Phase (Grades R to 3), Intermediate Phase (Grades 4 to 6) or a level consisting of the last six years of schooling, which is thus a combination of the Senior Phase (Grades 7 to 9) and FET (Grades 10 to 12). A key complexity of the schooling system lies in the fact that around 71% of learners are in schools which offer either Grades 1 (or R) to 7 or Grades 8 to 12, hence 'traditional' primary or secondary schools, meaning that the Senior Phase is split across schools (Gustafsson, 2016, p. 25). The rules deal with this reality by requiring Intermediate Phase teachers to be trained to teach Grade 7 classes as well as Grades 4 to 6. Up to Grade 7, teachers are required to be ready to teach all subjects, although they need only be competent in the teaching of one home language.

For teachers being trained for the Senior Phase plus FET level, there must be specialisation in two subjects (which could be language subjects), and teachers are not required to be trained in the teaching of subjects other than these two. In general, the 32 FET non-language subjects can be considered specialisations linked in a many-to-one fashion to the seven non-language subjects in the Senior Phase. According to the policy, a prospective teacher may specialise in one or two FET subjects. If one, then the other subject would be one of the Senior Phase subjects. Importantly, the subjects of Life Orientation (taken by all learners) and Mathematical Literacy are considered subjects in their own right which can be selected as specialisations. A teacher trained to teach Mathematical Literacy is not formally trained to teach Mathematics. The rules, plus the fact that FET subjects are likely to be more demanding than Senior Phase subjects, mean that all teachers trained for these levels would be in a position to teach at both the Senior Phase and the FET level. The rules require that at least one subject be an FET subject, so every teacher would be qualified to teach one or two subjects at that level. At the same time, someone choosing both subjects at the FET level would be qualified to teach at least one subject at the Senior Phase. Why might such a teacher only be qualified to teach *one* subject at the Senior Phase if two subjects are taken? This situation could arise if a student teacher opted for two FET subjects which were so similar that they corresponded to only one Senior Phase subject. The mapping of FET subjects onto Senior Phase subjects is thus important. This mapping is not provided in the Government Notice, although universities themselves implicitly produce a form of mapping when they determine subject choice rules for their students.

The rules in the Government Notice are used by universities, which must obviously limit the range of the two secondary level specialisations on offer and what two subjects may be combined in line with the make-up of the university's education faculty and the faculty's timetable.

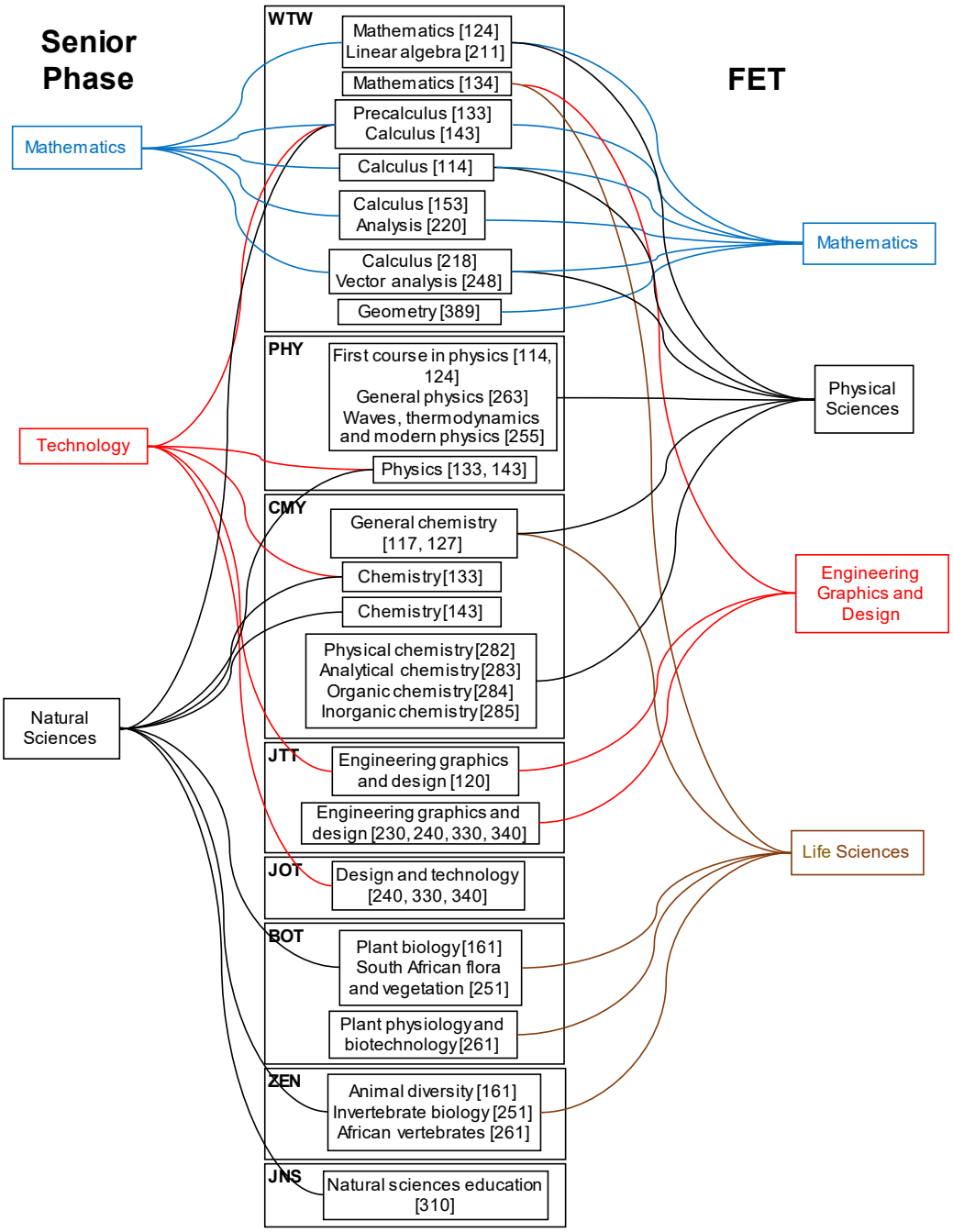
3.3.3 Implementation of national policy – example of the University of Pretoria

Figure 11 illustrates how one university, the University of Pretoria, puts the national policy on teacher specialisation in Grades 8 to 12 into practice. Although only one university receives attention, this should be adequate for a basic understanding of how secondary level teachers specialise. Senior Phase and FET subjects that prospective teachers are permitted to study are shown on the left- and right-hand sides respectively. As already explained in Section 3.3.2, a student teacher selects specialisation in either two FET subjects or one FET subject and one Senior Phase subject. Only science-related subjects are shown in Figure 11. Similar arrangements exist for other subjects. In the middle of the diagram, the various modules that make up the subjects are listed. The codes and numbers are those appearing in the 2018 University of Pretoria yearbook[13]. Three-digit codes starting in '1' are first-year modules, '2' are second-year modules and '3' are third-year modules.

13 Specifically, the guide BEd Senior Phase and Further Education and Training Teaching (09133031) was consulted https://www.up.ac.za/en/yearbooks/2018/pdf/programme/09133031) [Accessed October 2018].

Clearly, the overlap between Senior Phase and FET subjects is extensive, meaning that a good Senior Phase teacher is likely to cope relatively well with at least Grades 10 and 11, despite the fact that she is not formally trained for this with respect to a specific subject. For example, a Senior Phase Mathematics teacher takes almost all the modules that an FET Mathematics teacher would take – the only exception is that the FET teacher would take the third-year geometry module. A Senior Phase teacher in Technology would have completed the same first-year module 'Engineering graphics and design' as an FET teacher in the FET subject Engineering Graphics and Design. A key difference between a Senior Phase Natural Sciences teacher and an FET Life Sciences teacher is that only the latter could have taken a module on 'plant physiology and biotechnology', although both would have a grounding in 'plant biology' and 'South African flora and vegetation', and so on.

Figure 11: Science-related subjects at University of Pretoria



Note: Curved lines indicate which modules may be taken for qualification to teach specific school subjects. What the diagram does not reflect is that some modules are optional.

3.3.4 Grade- and subject-specific teaching in the DBE microdata

Understanding the extent to which teachers teach only one grade, which in general means teaching all or virtually all the subjects in that grade, is important for understanding teacher demand. The more this happens, the more important it becomes for teachers to be competent in all subjects. Moreover, where teachers teach more than one grade, it is important to know whether they also teach more than one *phase*. Insofar as they do, it becomes important for teachers to be prepared for a degree of 'phase-flexibility' without compromising on the need for specialisation.

The question of alignment between formal teacher specialisation and what teachers actually teach is complex and sometimes emotive. It is understandably considered non-ideal for teachers to teach outside the scope of their training, whether this is in relation to subjects or grades. However, the fact that teaching skills are often acquired outside formal training means that, for instance, a teacher trained for upper primary training (Grades 4 to 7) may be as competent at teaching Grade 8 to 9 English or Mathematics as a Senior Phase teacher with these subject specialisations. Teacher specialisation is only one of the factors that determine which schools and which learners teachers get to teach. Other influential factors include the teacher's preferences with respect to the location of the school, the teacher's preferences with respect to grade and subjects, and the availability of different teacher specialisations in different schools. It should thus not come as a surprise that there is considerable fluidity when it comes to the placement of teachers in subjects and grades. But how much fluidity is there? There is little data available to begin to answer this question, but there is some data which can help.

Table 10 uses the teacher questionnaire data from the 2017 *School Monitoring Survey* of the DBE (DBE, 2019). This survey covers a nationally representative sample of 2,000 schools. The teacher responses in this dataset should be interpreted with caution because of the way teachers were sampled in schools. Essentially, the focus was on collecting data from Grades 3, 6, 9 and 12 teachers who focused on teaching languages or Mathematics. Moreover, the Table 10 statistics do not use the weights from the dataset in order to simplify the presentation. Yet the statistics are useful. They indicate that around 24% of teaching occurs with the teacher not being trained to teach that phase. The figure of 24% is obtained by adding all the red values and dividing this total by the 8,626 surveyed teachers. For instance, four teachers reported that they taught at the FET level despite the fact that they were only qualified to teach at the Foundation Phase and Intermediate and Senior Phase levels. However, much of the 24% is accounted for by 1,153 teachers qualified to teach at the FET level, but who teach at the lower Intermediate and Senior levels. This is unlikely to be problematic from the perspective of teaching quality. If one considers only red values representing teaching at a *higher* level than the level one is qualified for, the figure for teachers teaching phases for which they are not equipped drops from 24% to 7%. Importantly, both these statistics barely differ by school quintile.

Table 10: Qualifications and actual teaching by level (2017 data)

Response to the question 'Please indicate what phase you have been trained to teach'			Actual teaching (with fractions of a teacher where multiple grades are taught)			Total teachers
Foundation Phase	Intermediate and Senior	FET	Foundation Phase	Intermediate and Senior	FET	
■	■	■	12	31	19	**62**
■	■		91	91	4	**186**
■		■	2	4	4	**9**
■			1,079	169	17	**1,264**
	■	■	8	505	549	**1,062**
	■		255	2,146	388	**2,789**
		■	39	1,153	2,062	**3,254**
1,521	4,099	4,387	1,487	4,097	3,042	**8,626**

Table 11 uses the same 2017 dataset to examine the number of subjects taught per teacher, considering just those 4,177 teachers teaching in Grades 10 to 12. Importantly, the great majority, or around 70%, of these teachers teach just one subject, and this does not differ much across quintile.

Table 11: Number of subjects taught by Grades 10 to 12 teachers (2017 data)

Quintile	One subject (%)	Two subjects (%)	Three or more subjects (%)	Total (%)
1	64	27	8	**100**
2	68	24	8	**100**
3	70	22	8	**100**
4	75	18	7	**100**
5	75	21	4	**100**
Overall	**70**	**23**	**7**	**100**

Unfortunately, the School Monitoring Survey does not permit a comprehensive analysis of whether Grade 10 to 12 teachers are teaching subjects which they specialised in during their teacher training. However, it is possible to extract what percentage of teachers teaching Mathematics in Grade 12 are qualified to teach this subject. Overall, 92% said they were. Better- off schools were in a slightly more favourable position: for quintile 5 the figure is 95%, compared to 91% for quintiles 1 to 3.

Table 12, reproduced from a DBE (2012b) report, draws on relatively old 2011 *Annual Survey* data. Specifically, data from the rarely used teacher questionnaire dataset which forms part of the overall *Annual Survey* dataset has been used. Only teachers in public ordinary schools were considered. Clearly, few teachers teach across both the Foundation Phase and the Intermediate phase – 1,008 of 314,330 teachers did this (shown in the first row of the table), plus a few of the 16,560 'less typical

combinations' teachers would also do this (shown in the second-last row). For the purposes of teacher demand, the Foundation Phase can be considered a more or less closed system. *Within* the Foundation Phase, teachers will often teach across grades within the same year. According to Table 12, around a third of them do so. (One arrives at this conclusion by adding the relevant values in the last column.) Similarly, few teachers teach at both the upper primary level (Grades 4 to 7) and the lower secondary level (Grades 8 to 9). This would in any case only be possible in combined schools. However, what *is* common is for teachers who teach Grades 8 or 9 to *also* teach in the FET band (Grades 10 to 12). If one considers just teachers who teach *only* in Grades 8 to 12 (which would exclude a small number of combined school teachers), one finds that 48% of teachers work in *both* the Senior Phase and FET band, 39% work *only* in the FET band, and 13% work *only* in Grades 8 and 9. This pattern clearly supports the policy described in Section 3.3.2, which requires all secondary level teachers to have at least one of their subjects at the FET level.

Table 12: Grade combinations of teachers (2011 data)

Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Gr 7	Gr 8	Gr 9	>Gr 9	Totals
■	■	■	■	■	■	■				1,008
■	■	■								2,683
■	■									2,553
■		■								703
■										24,843
	■	■								2,292
	■									18,361
		■								19,191
			■	■	■	■	■	■		1,598
			■	■	■	■				13,060
			■	■	■					14,906
			■	■		■				1,378
			■	■						7,384
			■		■	■				1,682
			■		■					1,900
			■			■				1,193
			■							11,163
				■	■	■				6,471
				■	■					5,209
				■		■				1,974
				■						7,642
					■	■	■	■		931
					■	■				8,752
					■					7,197
						■	■	■	■	852
						■	■	■		12,333
						■	■			1,827
						■		■		1,079
						■				9,603
							■	■	■	22,260
							■	■		10,095
							■		■	17,170
							■			3,325
								■	■	19,488
								■		3,236
									■	48,270
31,845	26,937	25,908	55,395	60,771	62,856	63,897	70,562	72,041	108,390	**314,330**
Teachers with less typical combinations not reflected above										**16,560**
Total number of teachers analysed										**330,172**

Note: The teachers were drawn from 21,426 schools.

Although the data reflected in Table 12 is now old, there are good reasons to believe that the patterns seen here would not have changed much. Around 96% of educators stay in the same school from one year to the next (Gustafsson, 2016, p. 66). Some of the remaining 4% would be due for retirement. These figures suggest most teachers stay for a long period of time in a single school. Moreover, school principals tend to stay in a school for at least ten years (Wills, 2015). All this suggests teacher utilisation practices would not change substantially over the years, especially considering that there has been no strong policy or incentive to drive change in this regard.

Table 13, which draws on the 2017 *School Monitoring Survey* data, confirms that the patterns have not changed much. Specifically, according to Table 13, 57% of teachers work in both the Senior Phase and FET band, 33% work only in the FET band, and 9% work only in Grades 8 and 9. Corresponding figures in 2011 were 48%, 39% and 13%.

Table 13: Grade combinations of teachers (2017 data)

Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Gr 7	Gr 8	Gr 9	>Gr 9	Total
■	■	■								108
		■								1,223
			■	■	■	■				170
			■	■	■					167
			■		■					112
				■	■	■				181
				■	■					228
					■	■				498
					■					645
							■	■	■	833
							■	■		410
							■		■	356
								■	■	1,423
								■		242
									■	1,522
194	238	1,576	675	890	2,297	1,127	1,738	3,046	4,209	8,118
Teachers with less typical combinations not reflected above										**508**
Total number of teachers analysed										**8,626**

Note: The teachers were drawn from 1 976 schools.

Table 14 illustrates important differences across school quintile with regard to grade-specific teaching, using the 2011 data. The situation is fairly similar across the grades in Grades 1 to 3, insofar as across quintiles, around two-thirds of all teachers teaching a grade teach only that grade. However, large differences are seen in Grades 4 to 7. Here, schools in more advantaged communities are far more inclined to practise single-grade teaching than schools in less advantaged communities. For instance, quintiles 4 and 5 schools are around three times as likely to do this as quintile 1 schools. Explanations

for this are not readily available, but one might speculate that two factors could be at play. Firstly, more disadvantaged schools are more likely to have multi-grade classes, since more of these schools are small rural schools. Secondly, in disadvantaged schools, there is likely to be a scarcity of teachers who are particularly proficient at teaching specific subjects, for instance Mathematics, which means that it would be advantageous to have such teachers teach only that subject, but across several grades. Yet across all quintiles, the most common practice in Grades 4 to 7 is to have teachers teach across grades, which would be with a focus on specific subjects. As one would expect, very few teachers in Grades 8 to 12 focus on only one grade. This is more likely to happen in very large schools with a large number of classes per grade. So, what are the implications of the Grades 4 to 7 situation for teacher demand? Although the policy for teachers at this level requires them to be ready to teach all subjects, it appears that an overwhelming majority of teachers specialise in certain subjects and teach these across several grades. This majority is even greater in disadvantaged schools. This should be investigated further using more recent data. There may be scope for allowing more subject specialisation during the pre-service training of teachers destined for the upper primary level.

Table 14: Percentage of teachers teaching in just one grade (2011 data)

	Q1	Q2	Q3	Q4	Q5	Total
Gr 1	69	72	78	76	60	**71**
Gr 2	58	59	69	68	52	**61**
Gr 3	62	64	71	68	51	**63**
Gr 4	9	13	21	32	27	**18**
Gr 5	5	8	13	20	18	**11**
Gr 6	5	7	12	19	16	**10**
Gr 7	8	10	15	23	21	**13**
Gr 8	3	3	5	7	4	**4**
Gr 9	4	4	5	7	2	**4**
Gr 10	6	6	6	6	2	**5**
Gr 11	3	3	4	4	1	**3**
Gr 12	5	5	5	5	3	**5**

3.4 Learner-educator ratios

The teacher demand model presented in Section 4.2 requires a breakdown of the LE ratio into four categories, *viz.* Grades 1 to 3 and Grades 4 to 7 at primary level, and Grades 8 and 9 and Grades 10 to 12 at secondary level. This section puts forward a methodology for obtaining these LE ratios whereby actual class sizes in schools are used to 'apportion' the LE ratio across the four levels used in the demand model. Actual class sizes are obtained using an approach which has apparently not been used in South Africa previously. Apart from currently applicable LE ratios, the model also requires future LE ratios based on certain assumptions. As shown below, by international standards South Africa's class sizes and LE ratios are high. This raises the obvious question of whether or not they should be reduced. This is a complex question in the context of competing budgetary priorities and discussions regarding how one best to improve learning in schools. The section tackles this question with reference to the

literature on school improvement, international comparisons of class size and LE ratio statistics, and existing norms in South Africa.

3.4.1 Existing class size and LE ratio values

First, an approach for arriving at useful class size and LE ratios per school is presented. South African data for 2015 was analysed, since class size data for this year was readily available. With respect to the LE ratio, 2015 *Snap Survey* data was used. For class size, the DBE's 2015 LURITS was used. LURITS includes a variable indicating in which class a learner is. For instance, Grade 1 in a school might be divided into the three registration classes: 1A, 1B and 1C. This variable allows for the calculation of the class sizes experienced by learners. However, before a proper analysis of the LURITS data is possible, it is necessary to exclude those schools whose records appear to be problematic. Specifically, where class specifications for specific grades were missing, schools were excluded from the analysis. Data for schools which clearly practised multi-grade teaching, in the sense that the total number of educators in the school was less than the number of classes, were not excluded, but were marked as multi-grade schools. After exclusions, 91% of schools and 90% of total public ordinary school enrolments were still included in the LURITS class data. Moreover, 82% of total enrolments were accounted for by schools which had class size data, *and* which were not multi-grade schools. As can be seen in Table 16, exclusions did not significantly impact on any particular quintile. The only obvious shortcoming here is that much of the Western Cape data had to be excluded. Statistics for this province clearly need to be interpreted with caution. Importantly, gaps in the data could reflect existing gaps within provincial information systems or gaps brought about during the process of merging the nine provincial datasets, standardising the coding, and so on.

Table 15: Percentage of learners covered by the registration class data

	Q1	Q2	Q3	Q4	Q5	All
EC	96	97	96	95	91	96
FS	94	99	98	99	100	97
GP	83	86	89	88	93	88
KN	99	98	98	98	95	98
LP	100	99	99	100	93	99
MP	98	99	98	76	90	97
NC	72	82	86	85	90	82
NW	98	98	96	82	58	95
WC	41	60	49	28	31	38
SA	94	95	93	79	78	90

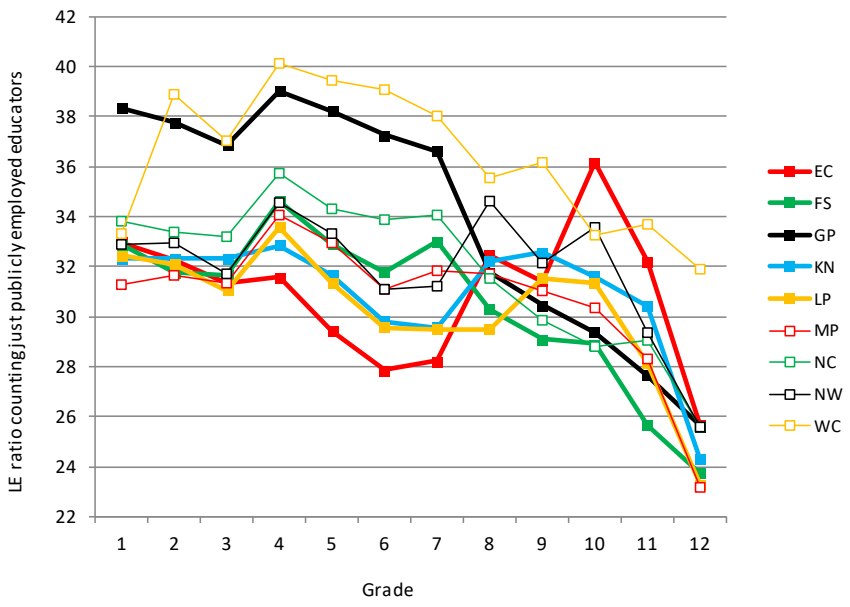
Table 16 provides further evidence that the exclusion of schools made virtually no difference to the LE ratios, with the exception of the Western Cape.

Table 16: LE ratios before and after exclusions

	Using all educators		Using publicly paid educators	
	Before	After	Before	After
EC	28.7	28.9	31.0	31.1
FS	27.8	28.0	30.2	30.5
GP	30.7	30.6	34.1	34.4
KN	29.4	29.5	31.2	31.2
LP	29.6	29.6	30.4	30.4
MP	29.4	29.5	30.8	30.8
NC	30.3	30.3	32.1	32.3
NW	30.8	31.0	32.8	32.7
WC	29.9	31.6	35.3	36.4
SA	29.6	29.7	31.9	31.7

The statistics shown in Figure 12 were calculated as follows. The number of classes per grade, according to the LURITS data, was obtained. Thereafter an 'entitlement factor' per grade was calculated. For example, if a school had 16 classes in total, of which three were in Grade 1, then the school's factor would be 0.188 for Grade 1 (3 over 16). This factor was then multiplied by the number of publicly paid educators in the school to obtain an estimate of the educators, or fractions of educators, who were likely to be involved in teaching a grade, even indirectly as managers. Hence, if there were 20 educators in the school, then the educators attached to Grade 1 would be 3.75. Then, for each province and grade, total enrolment was divided by attached educators. Schools with extreme or non-credible values were excluded. This resulted in 8% of schools being excluded.

Figure 12: Grade-specific LE ratios



The higher values at the primary level for Gauteng and Western Cape, with their largely urbanised populations, was to be expected. Western Cape's values would be approximately 1.0 learner lower if a higher proportion of data for this province had been used (see Table 16). The very large difference between primary and secondary levels in Gauteng is striking, and has been noted previously (Gustafsson, 2016, p. 48). The erratic curve for the Eastern Cape reflects an unusual school configuration in this province: around half of the provinces learners move through a system with schools which comprise Grades 1 to 7, followed by schools comprising Grades 8 to 12, while in the rest of the province they move through schools with Grades 1 to 9, followed by schools with Grades 10 to 12.

The middle column of Table 17 provides the aggregates of the statistics by the four levels.

Table 17: Baseline LE ratios for use in the model – Eastern Cape

Grades	LE ratio (using registration class)	LE ratio (using 2011 teacher work data)
1 to 3	33.1	
4 to 7	32.4	
8 to 9	31.7	35.4
10 to 12	28.8	27.0

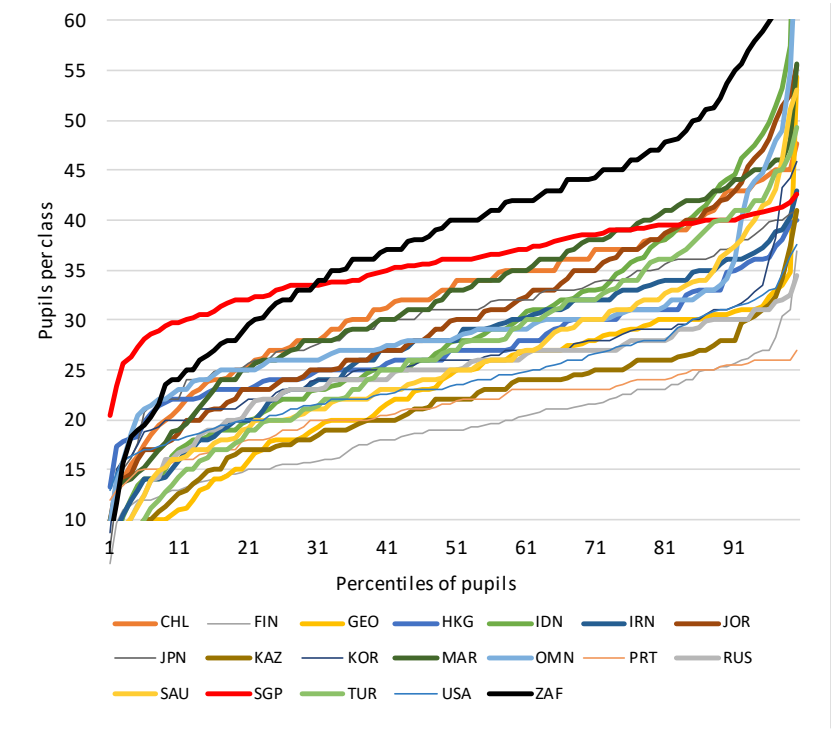
At secondary level, there is a serious problem with the two LE ratios in the middle column. These ratios are driven by the sizes of registration classes. While this may work adequately at the primary level, at the secondary level there are at least two likely problems. Firstly, there could be subject-specific teachers who are not attached to registration classes. Secondly, there is considerable fluidity between the two secondary levels. As pointed out in Section 3.3.4, approximately half of all secondary level teachers teach in both Grades 8 to 9 and in Grades 10 to 12. To arrive at better LE ratios for the secondary level, the 2011 *Annual Survey* data which was discussed in Section 3.3.4 was examined further. Specifically, it was assumed that teachers' time was equally spread across the grades which they said they taught. Thus, if a teacher taught Grades 9, 10 and 11, it was assumed that each of these three grades enjoyed a third of the teacher's time. Teachers distributed across grades in this manner were then divided into 2011 enrolments. This produced an LE ratio of 32.8 for Grades 8 to 9, and 25.0 for Grades 10 to 12. Both these ratios were raised by the same factor to produce the values 35.4 and 27.0 seen in the final column of Table 17. This increase was necessary to take into account the generally lower level of teacher availability, relative to enrolments, found in the 2015 data compared to the 2011 data.

3.4.2 Feasible class size and LE ratio targets

In considering what the above statistics at the primary level should be in future within the model, two analytical steps were taken. First, ideal maximum class size, beyond which no school should be permitted to go, were identified. Secondly, what an efficient relationship between a school's LE ratio and its maximum class size looks like was established using comparisons across South Africa's provinces together with comparisons across African countries, as well as a simulation of an ideal teacher allocation scenario in South Africa.

A class size threshold of 40 is important, since infrastructure norms specify that classrooms should be built to accommodate up to 40 learners[14]. As Figure 13 shows, in 2015 around half of Grade 5 learners in South Africa were in classes with more than 40 learners. (South Africa was the only country to enter Grade 5 learners into the 2015 the Trends in International Mathematics and Science Study (TIMSS) Grade 4 assessments)[15]. South Africa is clearly an outlier among developing countries shown in the graph. In Morocco, 21% of learners were in classes larger than 40, while in Indonesia and Jordan this was true for only 15% of learners. In other developing countries the situation was even better. Figure 13 supports the notion that classes with more than 40 learners are unusual and undesirable.

Figure 13: Grade 4 class size according to TIMSS 2015



Source: Own calculations using TIMSS microdata available at https://timssandpirls.bc.edu.

However, it should be kept in mind that within Africa, South Africa's primary level class sizes are about average. Several countries shown in Figure 14 had larger class sizes than South Africa, including Tanzania (by a large margin) and Kenya (by a small margin). Tanzania and Kenya are interesting examples since despite their large classes, in the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) assessments[16], they displayed test scores in reading and Mathematics which were considerably better than those of South Africa in 2007 and also (at least for Kenya)[17] in 2013 (DBE, 2018b). In fact, reducing class sizes is seldom put forward in the policy literature as an important means to improve learning outcomes. For instance, UNESCO's 2013/4 Global Monitoring

14 Government Regulation 920 of 2013: Regulations Relating to Minimum Uniform Norms and Standards for Public School Infrastructure. https://www.gov.za/sites/default/files/gcis_document/201409/37081rg10067gon920.pdf.

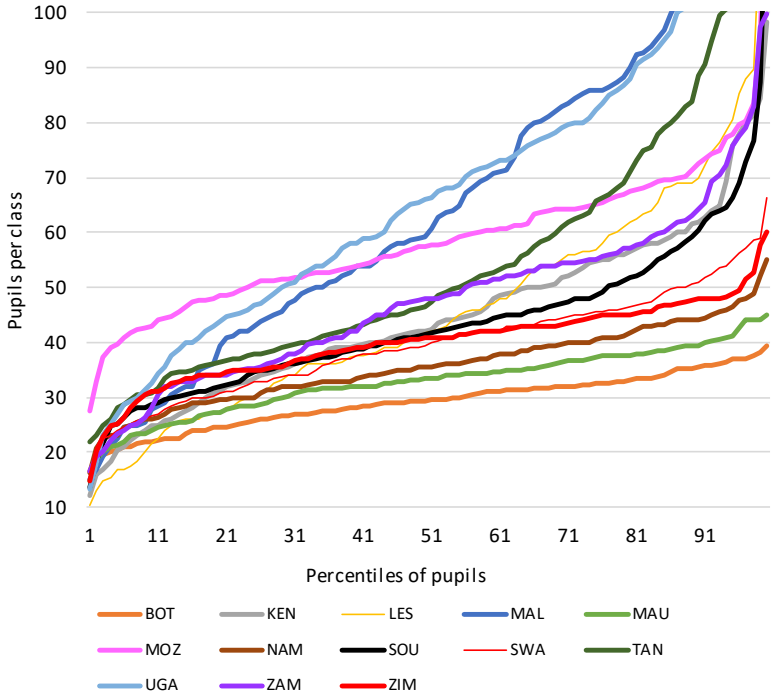
15 https://timssandpirls.bc.edu/timss2015/

16 http://www.sacmeq.org/

17 Tanzania's SACMEQ 2013 results do not appear to have been published.

Report (UNESCO, 2014), which focused on ways of improving learning outcomes, pays scant attention to achieving reductions in class size through the hiring of additional teachers as a noteworthy measure (although the report does discuss the problem of class size inequality due to an uneven geographical distribution of existing teachers). This needs to be seen in the light of the lack of evidence regarding class size reduction as an intervention that improves learning outcomes. It might sound strange to many that reducing a class size from, say, 50 to 40, would not result in improvements in learning. The lack of evidence in this regard is likely to be in part due to the fact that classes with 50 learners would also experience many other disadvantages, for example, poorly qualified teachers, making it difficult to separate effects from each other. Reducing class sizes, and hence overcrowding, can be seen not only as a measure to improve learning outcomes, but also as a means to address human rights, just as ensuring that schools have decent toilets is a human rights issue.

Figure 14: Grade 6 class size according to SACMEQ 2007



Source: Own calculations using SACMEQ 2007 microdata.

In short, it will be assumed below that ideally no learner should be in a class of more than 40 learners. Table 18 illustrates how complex the matter of an ideal maximum LE ratio is. The first hypothetical school is clearly extreme in the sense that it has just slightly more than 40 learners per grade, compelling the school to have two classes per grade across all grades in order to ensure that no class exceeds 40 learners. Assuming that two 'overhead' educators are required, for instance a school principal and a special needs teacher, who serve all grades, the school would need 16 educators in total, producing an LE ratio of 18.4. Intuitively, it might seem strange to require such a low LE ratio to satisfy a maximum class size of 40, yet clearly this can be seen as a necessity. The second hypothetical school represents the opposite extreme, where the actual enrolment patterns in the school fit neatly into a maximum of 40 rule. Here the school can get by with an LE ratio of 35. In reality, most schools would require an LE ratio of between 18.4 and 35 in order to comply with a maximum class size of 40 rule. The problem is that teacher allocation policies seldom, at least in developing countries, take into account the details

of the kind shown in Table 18 and therefore allow for different LE ratios per school. Such different LE ratios would have to respond rapidly to changes in enrolment patterns between one year and the next. Taking all the details into account is operationally too complex for many education authorities, meaning schools are essentially left with over-sized classes where enrolment patterns force this to come about. There is also something inherently attractive in having equal LE ratios across schools. Not only is this operationally easier, it is also easy to defend.

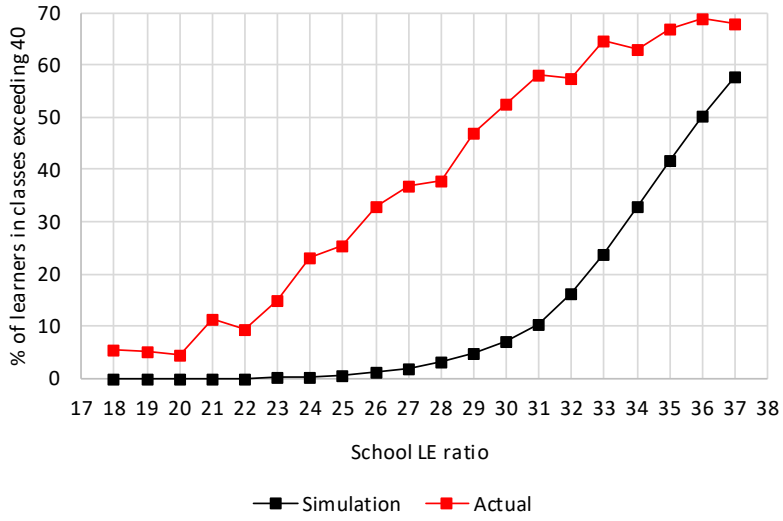
Table 18: Two hypothetical primary schools

	Class A	Class B	Total	Educators	LE
Hypothetical school 1					
Overhead				2	
Gr 1	21	21	42	2	
Gr 2	21	21	42	2	
Gr 3	21	21	42	2	
Gr 4	21	21	42	2	
Gr 5	21	21	42	2	
Gr 6	21	21	42	2	
Gr 7	21	21	42	2	
Total			**294**	**16**	**18.4**
Hypothetical school 2					
Overhead				2	
Gr 1	40	40	80	2	
Gr 2	40	40	80	2	
Gr 3	40	40	80	2	
Gr 4	40	40	80	2	
Gr 5	40	40	80	2	
Gr 6	40	40	80	2	
Gr 7	40	40	80	2	
Total			**560**	**16**	**35.0**

Figure 15 presents a vital analysis for informing future targets. The graph considers only schools offering Grades 1 (or R) to 7. The red curve represents the actual extent of ‘over 40’ classes in these schools. The LE ratio of each school, counting both publicly and privately paid educators, was rounded off to the nearest integer to obtain its score on the horizontal axis. (Who funds which teacher is immaterial in this analysis since the focus is on how schools can best optimise the time of the total available staff). For the score on the vertical axis, the average class size for a grade in a school was calculated. If this figure exceeded 40, then all the learners in the grade were considered to be suffering from an ‘over 40’ problem. The average across classes in a grade (where there was more than one class per grade) was found, as the problem is not so much individual classes exceeding 40, but that a distribution of enrolments across grades forces schools to have large classes. Thus, if in Grade 6 there is one class

of 35 learners and another of 41 learners, giving an average of 38, this is not viewed as an 'over 40' problem. It would be easy for such a school to remedy this situation by putting 38 learners in each class. What is not easy for a school to remedy is a situation in which the average class size for Grade 6 is 35 while that for Grade 7 is 41. In such a case, all Grade 7 learners are considered as suffering from the 'over 40' problem. We can see in Figure 15 that with an LE ratio above 22, one begins to see over 10% of learners with an 'over 40' problem. This is the actual situation.

Figure 15: LE ratio required to reach x% of learners in classes exceeding 40



The black curve in Figure 15 is the result of a simulation which worked as follows: *Snap Survey* data for 2015 for schools offering Grades 1 (or R) to 7 was used. Only enrolment by grade values was used. No actual educator or class size values were needed. The process started with an LE ratio of 37:1. The number of teachers which each school qualified to have was calculated. This was rounded up to the nearest integer. Of this number, at least one was counted as an 'overhead' educator who would not teach classes. If a school's total enrolment was 300, two overhead teachers were counted, while if it reached 600, three overhead teachers were counted, and if it reached 900, four overhead teachers were counted, and so on. This is roughly in line with current policies regarding the provisioning of deputy principals and schools-based heads of department. The total number of class teachers (non-overhead teachers) was then allocated across grades in a manner that minimised the percentage of learners in classes with more than 40 learners. This involved programmatically assigning each additional teacher to the grade with the highest average class size until all class teachers had been allocated. As Figure 15 shows, an LE ratio of 37:1 resulted in close to 60% of learners being in classes of over 40. The same calculations were then run for an LE ratio of 36, and so on down to an LE ratio of 18. Clearly, it is close to impossible to entirely eliminate the 'over 40' problem. Given actual enrolment patterns in schools, even an LE ratio of 22:1 across the entire schooling system results in 0.1% of learners being in classes with more than 40 learners. The question is, how much of this problem should be tolerated, given the high costs of reducing the LE ratio? The answer is driven in part by subjective opinion. At an LE ratio of 31:1, 10% of learners will be in classes over 40. At an LE ratio of 28:1, the figure falls to 3.1%. For the purposes of the teacher demand modelling below, the last scenario, which envisages an average LE ratio of 28:1, was considered the long-range target.

The gap between the red and black curves in Figure 15 suggests that there are vast inefficiencies in the ways that schools utilise teachers. The question is whether or not an efficient schooling system

would be able to get close to the black curve. Put differently, is the level of efficiency represented by the black curve simply an impossibility? Figure 16 breaks down the red curve from the previous figure by province. What is remarkable is how differently the relationship between the LE ratio and the 'over 40' problem plays itself out in different provincial systems. The graph confirms the need, often expressed in education circles, that provinces should learn more from each other. A school LE ratio of around 32 translates into roughly 30% of learners in classes over 40 in Gauteng, the Free State and Northern Cape, but around 65% in the other provinces (apart from the Western Cape). In these other provinces, the 'over 40' problem is at least twice as large as it needs to be, given the level of human resourcing. Western Cape's 'over 40' problem barely exists, although as mentioned earlier, this province's data is incomplete compared with that of other provinces, meaning that its statistics need to be interpreted with caution. In short, achieving the levels of efficiency suggested by the simulation does not seem impossible in the South African context. Several provinces are currently close to achieving this.

Figure 16: LE ratio required and actual provincial situations

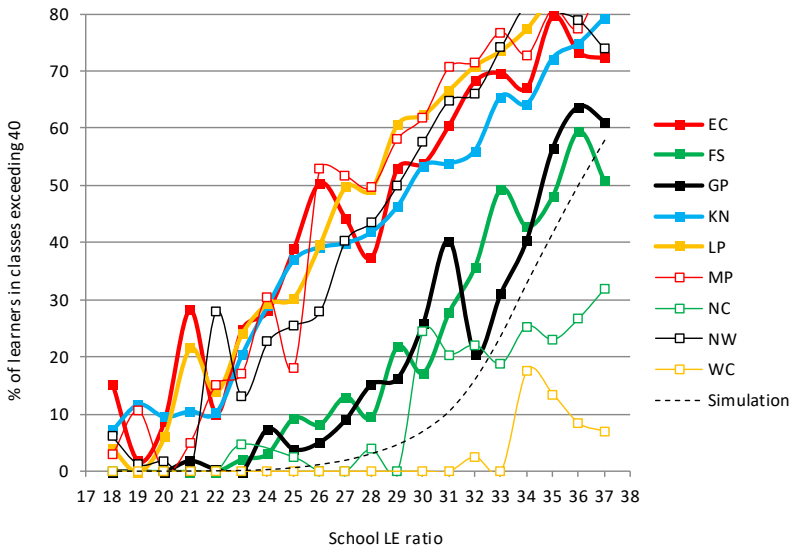
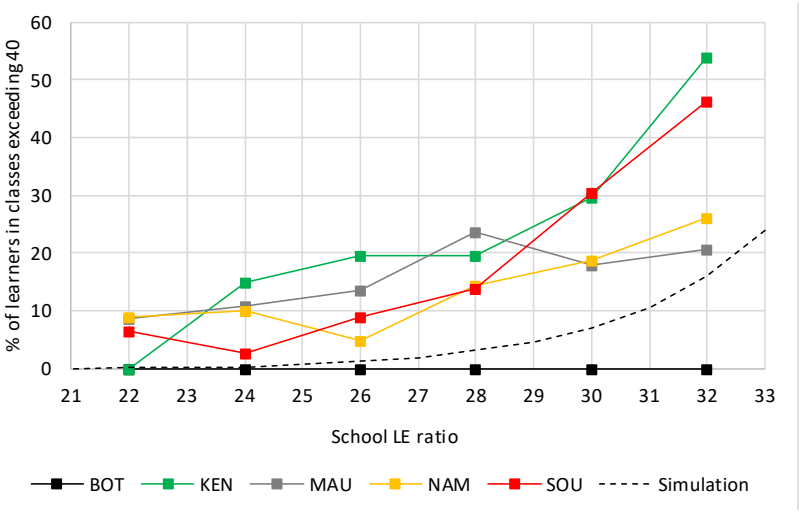


Figure 17 uses SACMEQ 2007 data to provide an analysis of the previous graph, but at an international level. Five particularly interesting SACMEQ countries were analysed. One advantage of the SACMEQ data is that it allows for the LE ratio of the school to be calculated, not just the class size (TIMSS data does not allow one to calculate the LE ratio). Clearly, South Africa's levels of inefficiency are unexceptional in the region. What seems exceptional is Botswana's apparent efficiency. At no level of the LE ratio do any learners sit in classes exceeding 40 (at least not in Grade 6, the grade tested by SACMEQ).

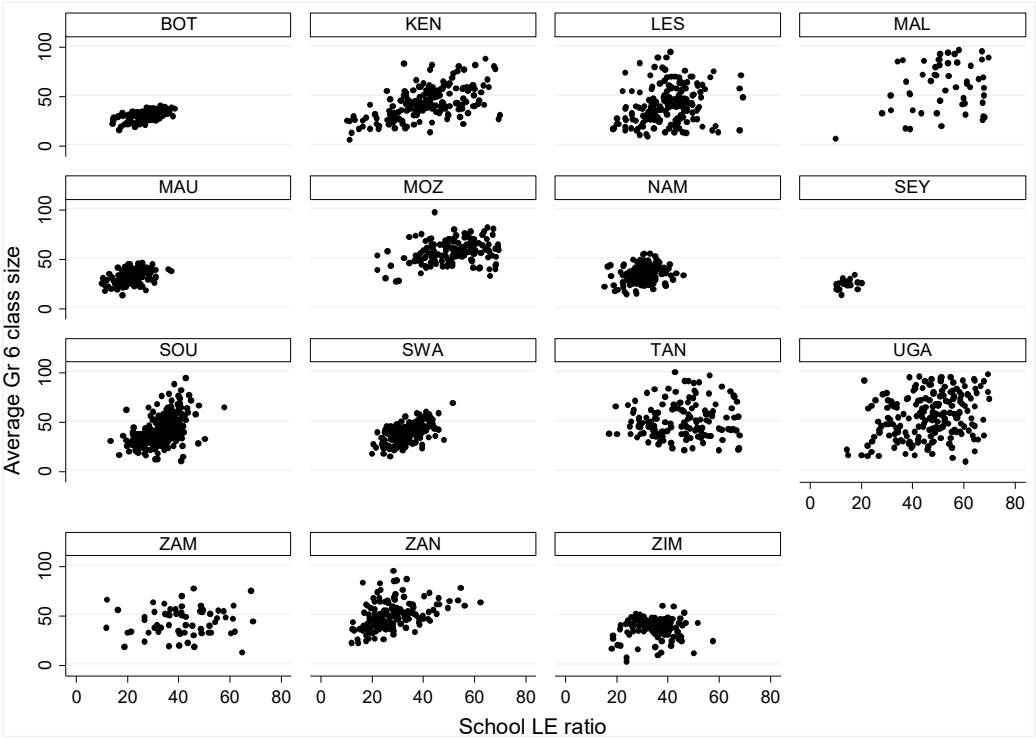
Figure 17: LE ratio required and actual SACMEQ country situations



Source: Each SACMEQ school's LE ratio was rounded to the closest multiple of two for this analysis.

In fact, it may be worthwhile to learn more about Botswana's practices. Clearly, Botswana is relatively well organised with regard to teacher planning. It is arguably the country in the region with the best published report on teacher supply and demand (see Section 2.1). Figure 18 moreover illustrates how exceptionally 'tight' the relationship is between school LE ratio and class size in Botswana. Each point is a school tested in SACMEQ 2007. Clearly, at particular levels of the LE ratio, class sizes vary little and are generally low in Botswana. The opposite extreme would apply in Uganda, where enormous inequalities in class sizes are seen for the same LE ratio. South Africa's pattern lies somewhere between the extreme inefficiency (and inequality) of Uganda, and the extreme efficiency (and equality) of Botswana.

Figure 18: Grade 6 class size and LE ratio in SACMEQ 2007 (school plots)

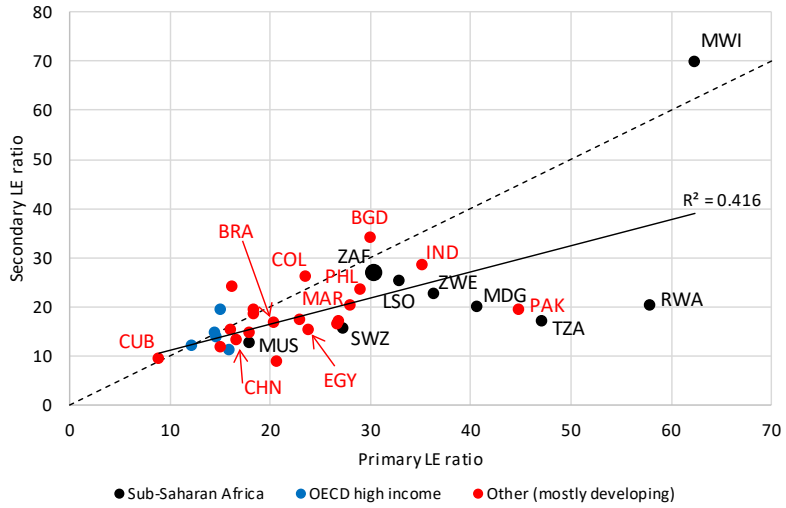


Analysis of the kind provided above of the relationship between the LE ratio and class size is surprisingly difficult to obtain, even for schooling systems outside South Africa. In the case of South Africa, this analysis appears not to have been done previously. It is, however, a vital analysis because the relationship between the two statistics, the LE ratio and class size, has evidently been misunderstood in the past. It is common to hear in South Africa that at the primary level, the LE ratio should be 40 and at the secondary level,35. These two figures originate in a norm agreed upon by unions and government in a landmark 1995 agreement[18]. Current ratios are well below these levels. For instance, as Table 17 shows, at the primary level the LE ratio stands at around 33:1. The Snap Survey data indicates that 15% of primary level learners are in schools where the LE ratio, counting only publicly employed educators, exceeds 40 (the norm for the primary level). Yet we have seen previously that approximately half of all primary school learners are in classes exceeding 40. Moreover, and this is critical, if an LE ratio of 40 was actually applied to schools (and fortunately it is not), the percentage of learners in classes exceeding 40 would be astronomically high, exceeding 60% (see Figure 15). Clearly, policymakers have misunderstood the relationship between LE ratio and class size, which is not surprising as so little analysis has existed. This misunderstanding, combined with the problem of limited available data on class size in previous years, has in all likelihood contributed to the problems of inefficiency and an overall under-supply of teachers as seen in the preceding paragraphs.

To conclude this discussion, an international comparison of LE ratios is helpful in determining whether or not global patterns support aiming for, say, an LE ratio of 28:1 at the primary level (as has been suggested above). Figure 19 draws on recent UNESCO data focusing on countries with which South Africa is sometimes compared (and which had the required data). The figure demonstrates the important trade-off between primary and secondary LE ratios. Of the 34 countries, only nine had a more generous (lower) LE ratio at the primary level than at the secondary level – these are the countries above the dotted line. There are probably two reasons why the reverse is true for most countries. One is that the more specialised nature of secondary education makes it necessary to have more teachers in secondary schools, so that small classes are possible, and teachers have additional non-teaching time to prepare learning materials. There appear to be very high 'runaway' LE ratios at the primary level in countries such as Madagascar (MDG), Pakistan (PAK), Tanzania (TZA), Rwanda (RWA) and Malawi (MWI). All these countries, with the exception of Malawi, have rather low LE ratios at the *secondary* level. This suggests that instead of planning prerogatives, there are political factors which can bring about a severe relative disadvantaging at the primary level. For instance, one such factor could be the greater political power of secondary level teachers, who are usually better educated. Where does South Africa fit into the international picture? South Africa appears to maintain a balance between the two levels, with just a slight favouring of secondary schools. This is likely to be at least in part due to the fact that salaries and qualification requirements for teachers in South Africa are very similar at the primary and secondary levels, a situation which is seldom found in developing countries. South Africa's secondary level teachers do not command considerably more political power than primary level teachers. The imperative for South Africa seems to be a need for more teachers generally, not a rebalancing of the distribution across the primary and secondary levels. There are several developing countries with primary level LE ratios well below that of South Africa: Mauritius (MUS) at 18, Brazil (BRA) at 20, China (CHN) at 17, Colombia (COL) at 24, Egypt (EGY) at 24, and Cuba at an extremely low level at 8 learners per educator. In light of this, aiming for an LE ratio of 28 at the primary level in South Africa appears to be a modest aim.

18 Education Labour Relations Council Resolution 4 of 1995: Guideline on learner:educator ratios. https://www.elrc.org.za/sites/default/files/documents/No%204%20of%201995.pdf

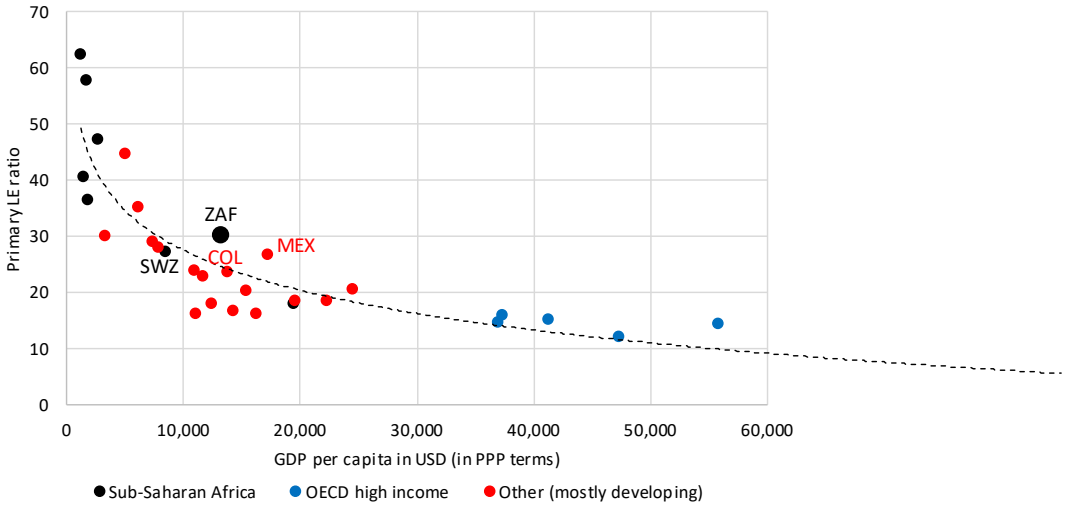
Figure 19: Primary and secondary LE ratios according to UNESCO



Source: Data from http://data.uis.unesco.org accessed November 2018. The dotted line represents an equal statistic at both levels. The solid line is a trendline.

Figure 20 shows only primary level ratios. It illustrates that South Africa is a high-LE outlier. Relative to GDP per capita, South Africa's primary LE ratio is around five learners higher than it should be, if one takes global trends as a norm. Reducing the LE ratio by 5 from 33:1 to 28:1 as has been proposed would take South Africa a long way towards where Colombia is today.

Figure 20: Primary level LE ratios against income according to UNESCO



Note: The data source and countries covered are as for the previous graph.

3.4.3 Subject-specific class size and teaching time norms in policy

Finally, the equations utilised in Section 4.2 recognise that different subjects in Grades 10 to 12 merit different class sizes. Class size norms are specified in the official model used to allocate educator posts

to schools and are reflected in the Personnel Administrative Measures of 2016[19]. Norms are ideal values which drive the distribution of a finite number of educational posts in the official model.

Table 19: Class size norms which are not 37 in Grades 10 to 12

Music	6
Visual Arts	12
Agricultural Management Practices	15
Agricultural Technology	
Civil Technology	
Dance Studies	
Engineering Graphics and Design	
Mechanical Technology	
Electrical Technology	20
Hospitality Studies	
Computer Applications Technology	25
Consumer Studies	
Information Technology	
Physical Sciences	30
Life Sciences	32
Mathematical Literacy	35
Mathematics	

The contents of Table 19, when viewed together with Table 8 on subject participation by quintile, raises an important question: to what extent do the class size norms bias teacher allocations in favour of the less poor, whose learners tend to take more specialised subjects? The answer is that the bias is far from negligible. The two tables (including the raw values underlying Table 8) produce average class sizes which are: 35.2 for quintile 1; 35.1 for quintiles 2 and 3; 34.4 for quintile 4; and 33.5 for quintile 5. The least poor schools benefit by having 1.7 fewer learners per class on average. However, there is a measure in the policy to counteract this. A pool of redress posts should be created, and these should be distributed in a pro-poor fashion. If the redress mechanism were employed to the maximum, it would, in fact, cancel out the inequality of 1.7 learners referred to earlier.

Although requirements for the time to be spent on each subject are not LE ratio standards, like LE ratios, these time requirements have an impact on the modelling of subject-specific teacher demand. The equations for the demand model presented in Section 4.2 require time per subject for Grades 8 to 12.

Table 20 provides hours per week to be dedicated to subjects offered to learners in the Senior Phase, which in terms of the demand model will be used for the Grade 8 to 9 calculations. These figures are drawn from the CAPS.

19 Employment of Educators Act 1998: Personnel Administrative Measures (PAM) Annexure A.1 of Government Notice 170 of 2016. http://www.gpwonline.co.za/Gazettes/Gazettes/39684_12-2_BasicEdu.pdf.

Table 20: Instructional time per week for subjects offered in Grades 8 and 9

Subject	Hours per week
Home language	5.5
First additional language	4.0
Mathematics	4.5
Natural Sciences	3.0
Social Sciences	3.0
Technology	2.0
Economic Management Sciences	2.0
Life Orientation	2.0
Creative Arts	2.0
Total	**28.0**

Table 21 provides the same information, but for Grades 10 to 12.

Table 21: Instructional time per week for subjects offered in Grades 10 to 12

Subject	Hours per week
Home Language	4.5
First Additional Language	4.5
Mathematics	4.5
Life Orientation	2.0
Additional subject 1	4.0
Additional subject 2	4.0
Additional subject 3	4.0
Total	**27.5**

3.5 Attrition of teachers

The extent to which educators leave the schooling system because of retirement or for other reasons obviously has a large impact on the demand for new teachers in each year. Future attrition is difficult to predict, above all as economic and social circumstances influencing the decisions of pre-retirement teachers change continuously. However, what can be predicted with some degree of accuracy is the number of teachers who will retire in future years. This figure is highly dependent on the age distribution of educators in the baseline and assumptions made about the ages of new joiners in future years.

The equations for the teacher demand model presented in Section 4.2 require a single annual attrition percentage for the baseline and future years. The percentage would be the percentage of educators

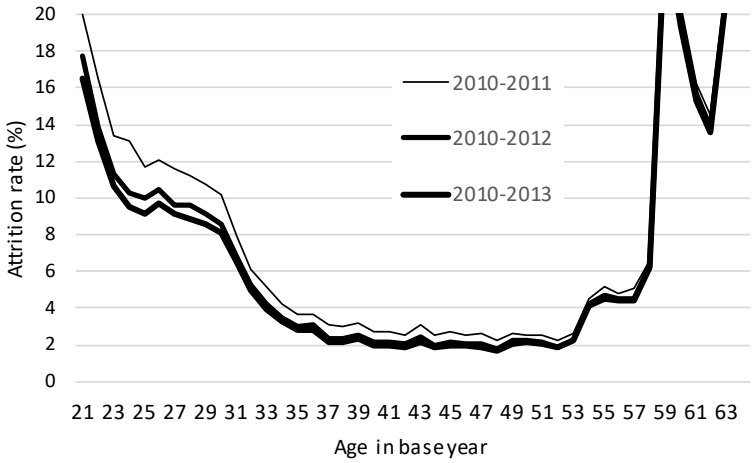
in the current year who would not be present by the next year, because they would have left. As will become clear below, modelling teacher attrition in future years is particularly complex, mainly due to the dynamics of pre-retirement exits. The fact that a model already existed for projecting future attrition is why a new set of algorithms within the teacher demand model presented in Section 4.2. was not pursued. The established model is a teacher and cost projection model which was developed in 2012 as part of a UNICEF-funded initiative conducted for the DBE[20]. This Excel-based model projects future attrition using the baseline distribution of teachers by age and assumptions around age-specific attrition for the ages 21 to 64 years in the base year, but also in a future year, with the trend between the base year and the future year being linear. Another set of assumptions in the model which are key for projecting attrition are those relating to the ages of new joiners. The 2012 model also projects future costs, but that is not directly a concern in the current report, which focusses only on teacher demand. The most recent data was inserted into the 2012 model to produce fresh projections, as explained below.

Two vital complexities relating to pre-retirement attrition are discussed here. The first is the complexity brought about by 'churning' or multiple joining and leaving by the same people. The second is the relationship between shifts in the size of the overall workforce and pre-retirement attrition.

Figure 21 illustrates the effects of churning on attrition statistics. The graph draws on PERSAL payroll data warehoused by the DBE, specifically data from each of years 2010 to 2013 for the month of October (for 2010 to 2012) or November (2013) for the nine provincial education departments. It will become clear further on in this discussion why a more recent set of years was not used. To illustrate, the '2010-2011' curve reflects the percentage of educators by their 2010 age who were not present in the 2011 data. The '2010-2012' curve reflects the percentage of 2010 educators who were not present in either the 2011 or 2012 data. The '2010-2013' curve was calculated in a similar fashion. It is clear from the differences between the curves that there is considerable 'churning' in the educator workforce. Attrition rates if one considers just movements between 2010 and 2011 are sometimes as much as two percentage points higher than if one considers data from three or four years. This is because there are educators who leave for a year and then return. This signals an important issue: one cannot consider only two years of data when estimating attrition, in the sense of predicting relatively permanent losses of educators, losses which constitute a key factor affecting replacement demand. Calculating attrition using only data from two adjacent years is likely to *over*-estimate permanent losses of educators, and hence the demand for new teachers. At the same time, analysis of the data for several different periods, including the closeness of the '2010-2012' and '2010-2013' curves in Figure 21, suggest that with four years of data – as in the 2010-2013 curve – it becomes more or less possible to capture permanent losses. Attrition does not drop much more if one adds additional years of data.

20 The Excel file accompanies Department of Basic Education (2012a). The original file is named *Costing tool 2012 06 01 (accelerated SA) (CURRENT MASTER).xls*, and the names of the two versions created for the current report are *CURRENT MASTER 2012 06 01 + just prim.xls* and *CURRENT MASTER 2012 06 01 + just seco.xls*. The files can be obtained from mgustafsson@sun.ac.za or Nuga.C@dbe.gov.za.

Figure 21: Age-specific teacher attrition for all educators

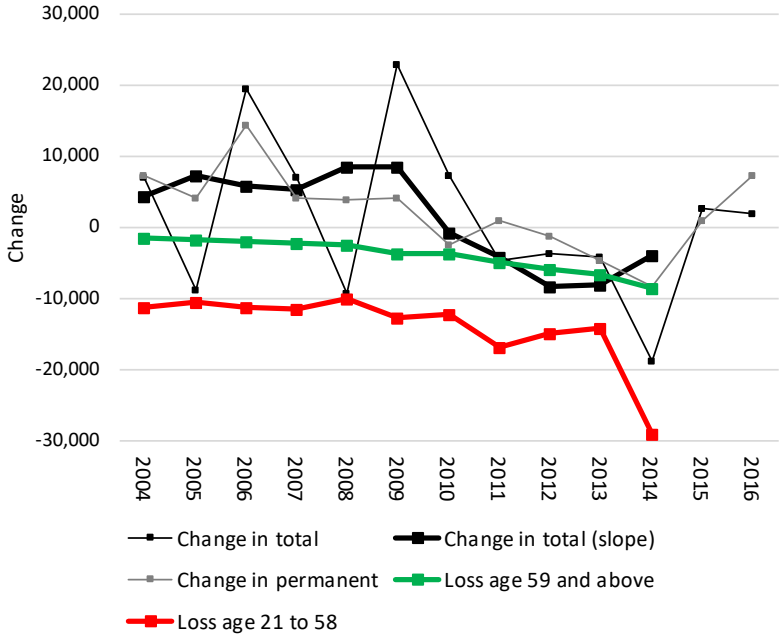


A much deeper and more detailed analysis of attrition than what is presented here is possible, although it would require a considerable volume of data and a great deal of effort. It needs to be emphasised that data for only one month in each year was used in the above analysis. Thus the 'churning' referred to may take the form of not only a temporary 'disappearance' in one year, but a temporary disappearance in just one month. For instance, someone not represented in the data for October 2011 may have been present in September and November of 2011. This is possible particularly in the case of educators on temporary contracts who see their contracts renewed from time to time. In fact, 'disappearance' may not represent actual absence from the workforce. It may also represent the fact that a teacher was off the payroll for, say, a month, and that back pay was paid out in the following month. The ideal would be an analysis of PERSAL data from several years *and every month of each year.* This would permit a much richer analysis than has been provided here.

The next two graphs address the second complexity, overall workforce growth and attrition. In Figure 22, the green and red curves represent leavers, taking into account four years of data at a time. For instance, the approximately 10,000 educators aged 21 to 58 who left in 2004 represent the number of educators who were present in 2004, but then completely absent in 2005, 2006 and 2007. What is clear is that pre-retirement attrition, essentially attrition up to the age of 58 years, can change substantially. In particular, the loss of 30,000 teachers in 2014 stands out. As has already been pointed out, for estimating the future demand of teachers, it is necessary to be able to make credible assumptions around *pre*-retirement attrition, meaning assumptions about the propensity of teachers to leave the sector permanently before reaching retirement age. Retirement attrition is relatively straightforward as choices are by that point limited. An educator must leave the system by the age of 65 years. For *pre*-retirement estimates of attrition, one should avoid using past values which reflect instability in the workforce. For instance, the high pre-retirement attrition in 2014 was accompanied by an abrupt shrinkage of the entire workforce, meaning factors such as not re-appointing teachers on temporary contracts would have played a large role. It would be better to look at pre-retirement departures during an earlier and more stable period.

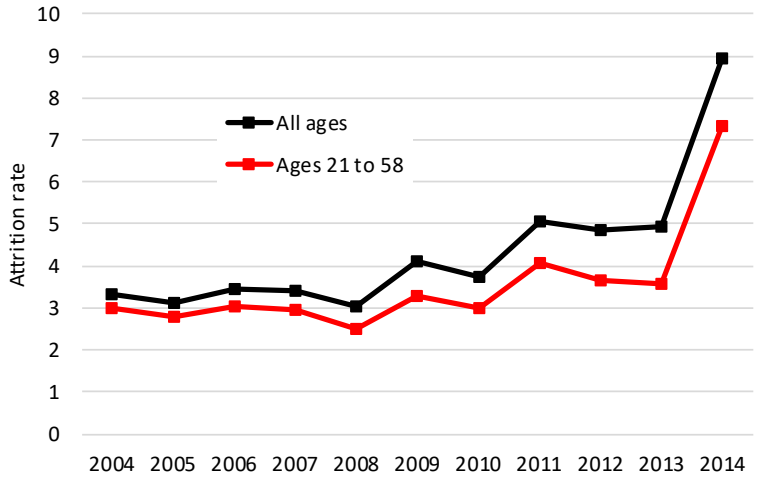
Figure 23 suggests that under normal circumstances, between 3% and 4% of educators aged 21 to 58 years leave each year and do not return (or at least not in the following three years). Why is the age of 58 years used as a cut-off here? The reason is that attrition rates for different years are very different for ages 58 and 59. This is clearly a critical time for many teachers. For example, for the '2010-2013' curve of Figure 21, attrition for age 58 is 6%, but for age 59 it is 25%.

Figure 22: Attrition and changes in workforce size



Note: For 'Change in total (slope)', the slope over four years in the total number of educators was used. For instance, the value of around 5,000 for 2004 indicates that between 2004 and 2007, the linear trend amounted to an increase of 5,000 teachers a year. 'Change in permanent' is the change in the number of permanently employed educators.

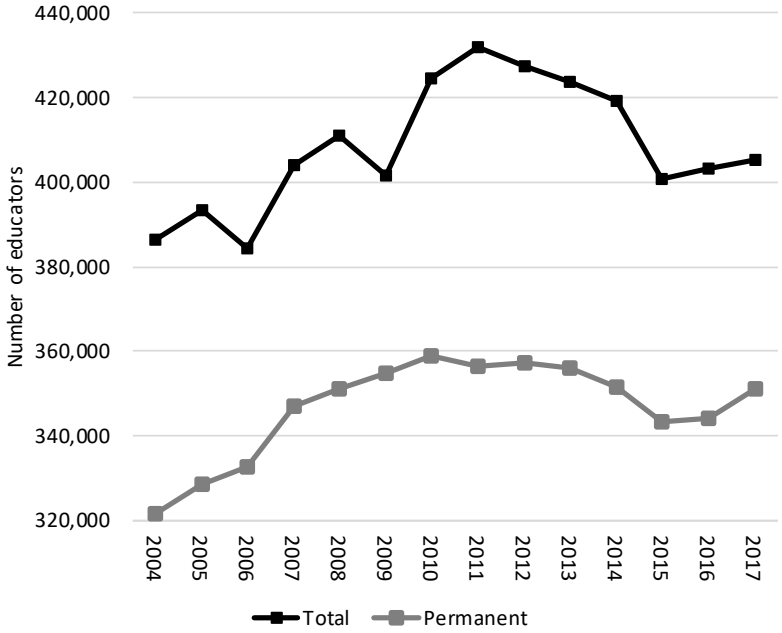
Figure 23: Attrition rates 2004-2014



Note: These attrition rates were all derived using the method of considering four years of data at a time. 'Ages 21 to 58' is leavers of this age group divided by all educators of this age in the base year in question.

Figure 24 simply shows educator totals for the years 2004 to 2017. Clearly, much of the instability discussed above came about as a result of changes in the number of non-permanent, i.e. temporary, educators.

Figure 24: Total and permanent educators in provinces

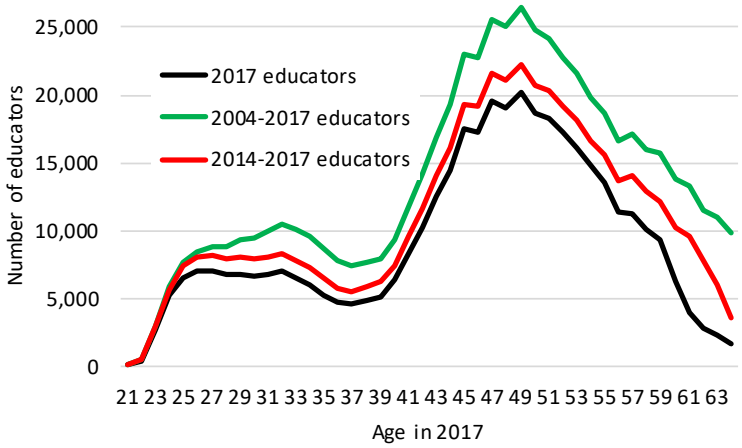


How do the attrition rates appearing Figure 23 compare with the attrition rates given in other reports? Crouch (2001) arrived at an attrition rate of 5.5% for 1998, using only two years of data. A comparable figure would be the overall attrition represented by '2010-2011' in Figure 21. That works out at 4.5%, not much lower than the 1998 level. Simkins (2015, p. 18) found that the attrition rate in 2013 might have been as high as 8.5%[21]. The DBE (2015a) has argued that a more accurate figure is likely to be higher than 8.5%, as a result of the data used for the calculation. In terms of global standards, South Africa's teacher attrition rates are not unreasonably high or different to attrition rates found in other sectors of the South African labour market. UNESCO (2006, p. 43) describes attrition rates of 5%, 6.5% and 8% respectively as 'low', 'medium' and 'high'. It appears that in recent years the attrition rate in South Africa has been below 5%, meaning that it is at a 'very low' level.

The churning referred to earlier implies that there is a pool of teachers who spend some of their time outside the set of publicly employed educators and would enter this set from time to time. It would be good to know how large this pool is, as this pool would itself have to be replenished by new teachers as it was depleted due to, for instance, people leaving the profession completely. Figure 25 below provides a sense of the size of this pool of educators. The red curve counts anyone who was in the system in any year in the 2014 to 2017 period. The gap between this curve and the black curve (people actually in the system in 2017) divided by people in the system in 2017 comes to 19%. However, if one considers only ages 40 to 49 years (using each person's age in 2017), the figure becomes a lower 11%. The figure of 11% is more reliable as it is not influenced by retirement. Of course, some of this 11% would be educators who permanently left the profession and were no longer in the 'pool'.

21 (1 112 + 28 256) / 342 096 in Table 13 of Simkins.

Figure 25: Educators inside and outside public employment



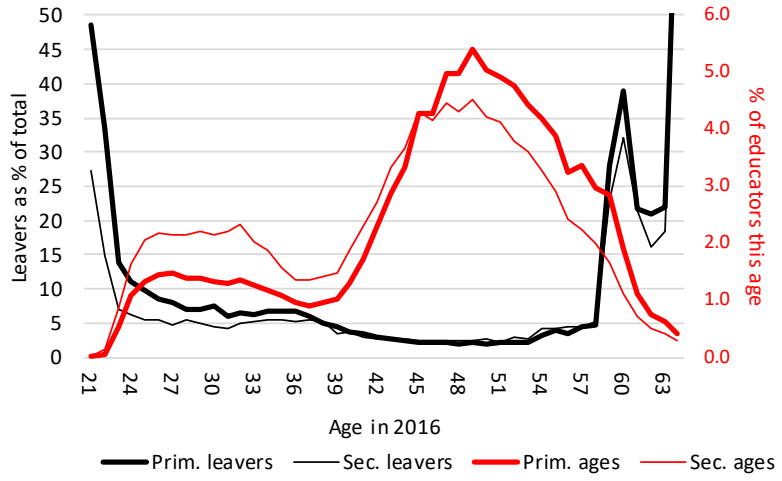
Note: The green curve is provided for illustration purposes. Clearly, the time period is too long for calculating the size of a pool available at one point in time. However, it comes to 594,000 educators. This is the number of people who appeared at any point in PERSAL as an educator employed by a province in the period 2004 to 2017.

It seems reasonable to assume that the pool available to feed teachers back into the system comes to around 7% of employed educators. If we assume a pre-retirement attrition rate of 3.5% (see Figure 23), by how much would one need to adjust this upwards to allow for the replenishment of the reserve pool? The following equation suggests 3.5% would have to become 3.7%. (a_1 is the 3.5% attrition, E is total employed educators in 2017, and s is the assumed size of the reserve pool as a percentage of employed educators, so 7%.)

$$a_2 = \frac{a_1\left(E \times (1+s)\right)}{E}$$

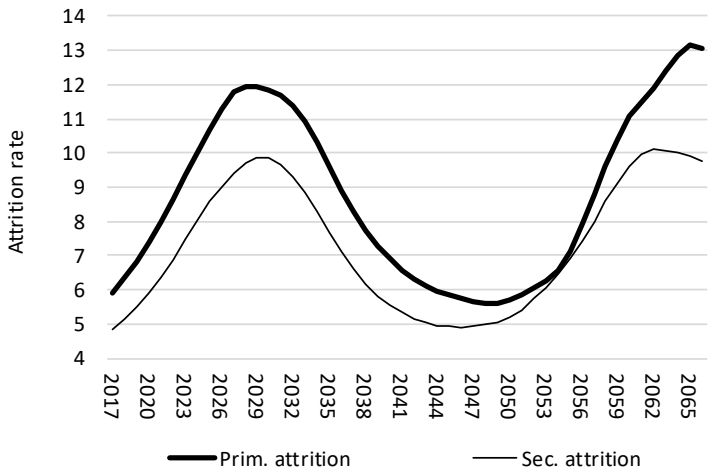
If one uses only the attrition seen between 2016 and 2017 and multiplies each age-specific attrition rate by the same factor but just in the age range 21 to 58 years to force an overall attrition rate (for this age range) of 3.7%, one gets what is shown in Figure 26 below. Here the primary and secondary levels have been calculated separately, using just schools offering a grade no higher than Grade 7 (primary) or a grade no lower than Grade 8 (secondary). The pre-retirement attrition patterns are rather similar for the primary and secondary levels. Moreover, the attrition rates based on 2016-2017 data display the same distribution across ages as what was seen when 2010-2011 data was used (Figure 21). In both cases, attrition is higher for younger teachers (around ages 21 to 35 years) than for more middle-aged teachers (ages 40 to 55 years). This is a pattern commonly seen in educator workforces around the world. The high attrition rates for ages 59 to 64 years seen in Figure 26 below are not the result of any adjustment. They reflect what the 2016 to 2017 actual trends reveal.

Figure 26: Educator numbers and their attrition by age



The age-specific attrition rates shown in Figure 26 were inserted into the 2012 teacher projection model discussed above. Duly formatted PERSAL data from November 2017 was inserted as the baseline data. The model was then run, separately for the primary and secondary levels, producing the global attrition rates per year seen in Figure 27 below. These global attrition rates are then the values for variable *a* described in Section 4.2. The two peaks in Figure 27 stand out. The first one comes about when the age peaks – the highest peaks of the two red curves in Figure 26 – reach retirement. Because the age distribution curve for secondary teachers is flatter than for primary teachers (in Figure 26), the first overall attrition peak in Figure 27 is lower for secondary teachers. How do the second couple of peaks in Figure 27 come about? They arise as the left-hand small peaks in Figure 26 reach retirement. These peaks may seem small currently, but they will (and should) grow considerably in order to compensate for the imminent surge in retirements in the period extending to around 2030.

Figure 27: Overall attrition rate 2017-2066



4 Data analysis and results

4.1 The data and policy assumptions used

Section 3 provides details regarding data and assumptions which informed the teacher demand model. The 'demonstration model' is an initial rendition of the model with a specific set of values and assumptions. The demonstration model is the 'largely business-as-usual' scenario referred to in Section 4.3.2 below. The basis for the model is summarised in the following table. The present year is 2018.

Importantly, 'teacher' is understood to mean any *full-time educator employed by a provincial education department and working in a public ordinary school*. This would include permanent and temporary employees. It would also include schools-based managers such as principals and deputy principals. Although no-one moves into the schooling system and immediately becomes a school principal, school principals are an integral part of the demand and supply cycle. When a principal retires, she may be replaced by another senior educator in the school, but then the position of this person becomes vacant and that could be filled by a new entrant.

Summary of data sources and projection assumptions		
	Past and present values	**Projections**
School enrolments	The DBE's 2018 official enrolment report (*School Realities, DBE, 2019b*).	Three enrolment scenarios stretching to 2030 and already developed for a 2017 report, discussed in Section 3.1 above, were used. The demonstration model uses the BAU scenario from that report. Beyond 2030, enrolments were kept static given the absence of enrolment projections for that period and given that shifts in the young population would be a relatively minor driver of teacher demand.
Language of learning and teaching	For the Foundation Phase, values from the first column of Table 1 were used.	The baseline situation was assumed to continue. There is no reason to believe that the language breakdown would change substantially.
Subject choices of learners	For Grades 10 to 12, the Grade 12 language and non-language breakdowns seen in Table 5 (second column) and Table 6 (second column) were used. For Grades 4 to 7, the language breakdown found in the Foundation Phase was assumed. For Grades 8 to 9, the Grades 10 to 12 breakdown was used.	No subject-specific prioritisation was implemented, meaning no value for p above 1.00 was assigned (p is explained in Section 4.2 below).

Summary of data sources and projection assumptions		
	Past and present values	**Projections**
Learner-educator (LE) ratios	LE ratios from Table 17 were used – first column of that table for Grades 1 to 7, second column for Grades 8 to 12.	For Grades 1 to 7, a target of 28:1 by 2030 was set (and then maintained thereafter), in line with the international comparisons presented in Section 3.4. The LE ratio change from 2018 to 2030 was assumed to be linear. No LE ratio change for Grades 8 to 12 was set.
Attrition of existing teachers	An attrition rate, which includes retirements, of 6.3% for Grades 1 to 7 teachers and 5.2% for Grades 8 to 12 teachers was used. This is what was illustrated in Figure 27.	An existing 2012 teacher projection model was adapted to provide expected attrition. This would be driven by constant pre-retirement attrition (at 3.7%) and changing retirement attrition, depending on age distributions. This is explained in Section 3.5.

4.2 Equations used

Equation 1 and 2, given below, show how the annual demand for additional teachers at the lower primary level, or Grades 1 to 3, in public schools is calculated. The lower primary level is thus the Foundation Phase without Grade R (Grade R teacher demand is discussed in Section 5).

Equation 1 is used to calculate the *total* (not just additional) demand for teachers *T*, in year *Y* with language specialisation *L*. Equation 2 is used to calculate *TJ,* or the number of teachers who would need to join the public workforce in year *Y.* Turning to the right-hand side of Equation 1, *S* is total learners at the lower primary level. *LE* is the desired learner-educator ratio in year *Y.* The last factor in Equation 1 determines how many teachers are required for language *L*. The number of learners who would take language *L* as their home language in the base year (*Y* = *B*) is divided by all students in the base year. The use of the base year means that the proportion of teachers required for each language remains constant across all years.

Equation 2 is used to calculate the flow of teachers with language specialisation *L* joining the workforce in year *Y* if the required stock $T_{L,Y}$ is to be maintained. The first set of brackets contains the inflow required to deal with growth in the schooling system (this could be negative if the system is shrinking). This is the number of teachers required in the current year minus the teachers required in the previous year. The second set of brackets contains replacement demand, or teachers who must be brought in (at the start of year *Y*) to deal with those who left (at the end of) the previous year. This is calculated as the number of teachers in the previous year multiplied by the attrition rate *a*, which is specific to a year (there are, moreover, different values *a* for the primary and secondary levels). There would be eleven *TJ* values for each year, corresponding to the eleven official languages.

$$T_{L,Y} = \frac{S_Y}{LE_Y} \times \frac{S_{L,Y=B}}{S_{Y=B}} \qquad \text{(Equation 1)}$$

$$TJ_{L,Y} = \left(T_{L,Y} - T_{L,Y-1}\right) + \left(T_{L,Y-1} \times a_{Y-1}\right) \qquad \text{(Equation 2)}$$

These equations would also be used to calculate teachers needed each year at the upper primary level, or the Intermediate Phase plus Grade 7 (as explained in Section 3.3.2, this combination is used in policy). For the upper primary level, there would also be eleven *TJ* values per year, but their meaning would be different from that of the lower primary level. The breakdown by language would serve as a rough guide from which one could deviate considerably. As discussed in Section 3.3.4, the great majority of teachers in Grades 4 to 7 teach in more than one grade, meaning they specialise in one or a few subjects, as opposed to teaching all subjects in one grade. It is thus not too serious a problem if, say, the supply of new teachers able to teach isiXhosa is lower than what is specified in the demand figure. One could make do with fewer isiXhosa teachers if the available isiXhosa teachers focus strongly on teaching this language and leave other subjects to other teachers. However, the breakdowns in the demand by language do have some meaning. It is probably beneficial for most or all teachers working in a school where all learners take isiXhosa as a home language to be fluent in this language in order to facilitate comprehension in, say, the Mathematics class. It should be remembered that up to Grade 3, learners would be studying Mathematics in isiXhosa. Although the breakdowns by language would not represent a hard demand, what would be a hard demand is the *total* number of teachers needed at the upper primary level.

Equations 3, 4 and 5 deal with lower secondary grades, or Grades 8 and 9. Very importantly, the aim here is to determine how many *full-time equivalent teachers who are trained with a lower secondary specialisation* are needed. As pointed out in Section 3.3.2, teachers with a specialisation in the Senior Phase – Grades 8 to 9 for the purposes of the current discussion – must also be 50% specialised in the FET level (Grades 10 to 12). Thus, if 100 teachers are required at any one point in time to teach Grades 8 and 9, all 100 would each have spent 50% of their university studies focusing on Grades 8 to 9 teaching. The rest of their time would have been spent focusing on Grades 10 to 12. This means universities would have had to train all 100 teachers, but each teacher would only need to receive 50% of a full-time package of training. Thus, universities would have had to train 50 *full-time equivalent* students in Grade 8 to 9 teaching.

In **Equation 3**, *d* represents the 50% of their training that Grade 8 to 9 teachers would have had to devote to Grades 10 to 12 teaching. The rest of Equation 3 is similar to Equation 1. *TL* is full-time equivalent teachers with a training in Grade 8 to 9 teaching, and *LEL* is the LE ratio at the lower secondary level (each ends in 'L' for lower secondary, as these variables must be re-used in the FET level equations).

Equation 4 is lower secondary teachers (remember this is full-time equivalent) with specific language specialisations. Of the 28 hours of teaching received by each learner in a week, 9.5 hours is accounted for by the home language (5.5 hours) and the first additional language (4.0) hours – see Table 20 above. In Equation 4, *i* is the percentage of *Grade 12* learners taking language *L* in the base year *B*. The sum of all values *i* would be 200%, as every learner takes two languages. This is why the last factor must be divided by 2.

Equation 5 is used to calculate the number of teachers with a specialisation in some non-language subject. Here *h* is the hours in a week for subject *N,* taken from Table 20. The value 28 is the sum of all hours from Table 20. Calculating the number of joiners for the lower and upper secondary levels requires using Equation 2, described earlier.

$$TL_Y = \frac{SL_Y \times (1 - d)}{LEL_Y}$$ (Equation 3)

$$TL_{L,Y} = TL_Y \times \frac{9.5}{28} \times \frac{i_{L,Y=B}}{2} \quad \text{(Equation 4)}$$

$$TL_{N,Y} = TL_Y \times \frac{h_N}{28} \quad \text{(Equation 5)}$$

Equations 6 to 14 deal with teacher demand by FET subject. The basic approach for this level is as follows: Apart from future enrolments, two key factors drive future total demand. One is the overall LE ratio – this factor is also used at the lower levels. A second is a subject prioritisation factor *p* – this was not used in the lower levels. A few *non-language* subjects, but not too many, could be prioritised for relative enrolment growth. For instance, Computer Applications Technology could carry values for *p* which start at 1.00 in the base year and rise linearly to 3.00 by 2030, meaning enrolments in this subject would triple. Projecting growth in a set of growth subjects means *reducing* enrolments in non-growth subjects because each learner takes just seven subjects. The reason why the calculations for the FET level are quite complex is that the two targets, the changing overall LE ratio and the subject-specific prioritisation, interact. Importantly, subject prioritisation ultimately overrides the overall LE ratio because subject-specific LE ratios from the base year are respected across all years. What this means is that if subjects with low (favourable) LE ratios in the base year are prioritised for growth, this would push the overall LE ratio down, even if there was no target aimed at reducing the overall LE ratio. If, in addition to prioritising certain subjects, one also wanted to reduce subject-specific LE ratios relative to what is found in the baseline, then one would set as a target a reduced future overall LE ratio. The Excel tool makes it clear what the ultimate *actual* overall LE ratio would be in future years, which may not be the same as the *envisaged* overall LE ratio if subject-specific growth was also envisaged.

Equation 6 calculates the number of learners in Grades 10 to 12 taking subject *V*, which can be a language or non-language subject, in the base year *B*. The sum of the values *i* referred to here is 700%, as each learner in Grade 12 (and Grades 10 and 11) takes seven subjects. For *i,* public school values from Table 5 and Table 6 were used. Tiny adjustments were applied to ensure that the sum for the language subjects was 200% and the sum for the non-language subjects was 500%. In the case of the three subjects in Table 6 with a value of zero, a value of 0.1% was inserted.

Equation 7 calculates the enrolment in a future year in a subject which is prioritised and hence experiences growth relative to other subjects, *without taking into account overall increases in enrolments or demographic change*. So it is assumed that total enrolments in Grades 10 to 12 remain static. The asterisk * indicates that one is dealing with a prioritised subject.

Equation 8 calculates the value of *p* for non-prioritised subjects. Hashtag # denotes a non-prioritised subject. In each year, every non-prioritised subject carries the same *p* value, and this value is always 1.00 (if no subjects have been prioritised) or less than 1.00. The numerator on the right-hand side of Equation 8 is the subject participants in non-prioritised subjects in year *Y*, *assuming no demographic change*. The denominator is subject participants in non-prioritised subjects in the base year *B*, in other words before prioritisation kicks in. Baseline enrolment *S* is multiplied by 7 to produce total subject participants in the base year.

Equation 9 is used to calculate future subject-specific enrolments by inflating base year enrolments per subject by two factors: the prioritisation factor *p* (whether for a prioritised or non-prioritised subject) and a factor capturing demographic growth.

Equation 10 produces, for the base year, subject-specific hours of teaching per week, or *W.* This is enrolments in the subject in the baseline, multiplied by the hours per week required for the subject (from Table 21), divided by the ideal subject-specific LE ratio in policy (from Table 19).

$$S_{V,Y=B} = S_{Y=B} \times i_{V,Y=B} \quad \text{(Equation 6)}$$

$$SN_{V*,Y} = S_{Y=B} \times p_{V*,Y} \quad \text{(Equation 7)}$$

$$p_{V\#,Y} = \frac{(S_{Y=B} \times 7) - \sum_{V*} S_{V*,Y}}{(S_{Y=B} \times 7) - \sum_{V*} S_{V*,Y=B}} \quad \text{(Equation 8)}$$

$$S_{V,Y\neq B} = S_{V,Y=B} \times p_{V,Y} \times \frac{S_Y}{S_{Y=B}} \quad \text{(Equation 9)}$$

$$W_{V,Y=B} = S_{V,Y=B} \times \frac{h_V}{LE_V} \quad \text{(Equation 10)}$$

$$TU_{V,Y=B} = \frac{S_{Y=B}}{LE_{Y=B}} \times \frac{W_{V,Y=B}}{\sum_V W_{V,Y=B}} \quad \text{(Equation 11)}$$

$$TU_{V,Y\neq B} = T_{V,Y=B} \times \frac{S_{V,Y}}{S_{V,Y=B}} \times \frac{LE_{Y=B}}{LE_Y} \quad \text{(Equation 12)}$$

$$TL_{V,Y} = \frac{SL_Y \times d}{LEL_Y} \times \frac{TU_{V,Y}}{\sum_V TU_{V,Y}} \quad \text{(Equation 13)}$$

$$T_{V,Y} = TU_{V,Y} + TL_{V,Y} \quad \text{(Equation 14)}$$

Equation 11 produces the total teachers per subject required at baseline, for now using only Grade 10 to 12 enrolments. *TU* is thus teachers at the upper secondary level. The total number of students is divided by the overall LE ratio which actually exists in the base year. This is then multiplied by the percentage of overall time subject *V* requires, which is *W* for that subject divided by the sum of all values *W.*

Equation 12 produces teachers demanded for Grades 10 to 12, and per subject, in future years. The baseline subject-specific value of *T* is inflated (or deflated) by two factors. The first deals with the trend in the subject enrolment, and is total subject enrolment in the current year over total enrolment in the baseline year. The second deals with the desired LE ratio trend, and is the LE ratio in the base year over the envisaged ratio in the current year. The numerator must be the base year value here as the LE ratio is inversely proportional to teachers required. *T* is full-time equivalent teachers. For instance, 10 Mathematics teachers would in fact be 20 teachers who have Mathematics as one of their subject specialisations.

Equation 13 brings in teachers who actually teach Grades 8 to 9, but whose qualification focusses on Grades 10 to 12. Again, this is about full-time equivalent teachers. This count of teachers, *TL,* is spread across subjects in the same proportion as *TU*, teachers who actually teach Grades 10 to 12.

Finally, **Equation 14** adds *TL* and *TU* to produce a total number of full-time equivalent teachers *T* whose specialisation is teaching at the Grade 10 to 12 level.

4.3 The teacher demand figures

4.3.1 A largely business-as-usual scenario

By 'business-as-usual', or BAU, what is meant is, firstly, that repetition and dropping out patterns among learners do not change much, and that there is no change in the distribution of learners across subjects in Grades 10 to 12. The presentation of the scenario begins at the aggregate level – see Figure 28 below. The graphs in the current section are all taken from the Excel file *Teacher demand 2020 03 28 (BAU).xls.* Do the baseline figures in this graph tally with published values? It is important to check this as the total demand and total joiners baseline values are calculated values, not raw values inserted into the model. For instance, the total demand value draws from a complex treatment of LE ratios. The 2018 baseline value used for Figure 28 is 361,655. The DBE's 2018 *School Realities* publication (DBE, 2019b) indicates that there were 398,789 educators in public ordinary schools in that year. Of these, around 29 000 would have been privately paid educators in public schools (DBE, 2018c, p. 12), leaving around 370,000 publicly paid educators (the educators the model is concerned with). The difference between this 370,000 and the 361,655 represented by the graph is small, and some of it could be owing to the fact that some Grade R teachers had been counted in the 370,000. It should be remembered that the primary purpose of the model is to gauge *change* in demand and how this affects the need for joiners. Moreover, within any year, the number of educators is not static: it fluctuates from month to month.

Figure 28: Total demand and demand for joiners

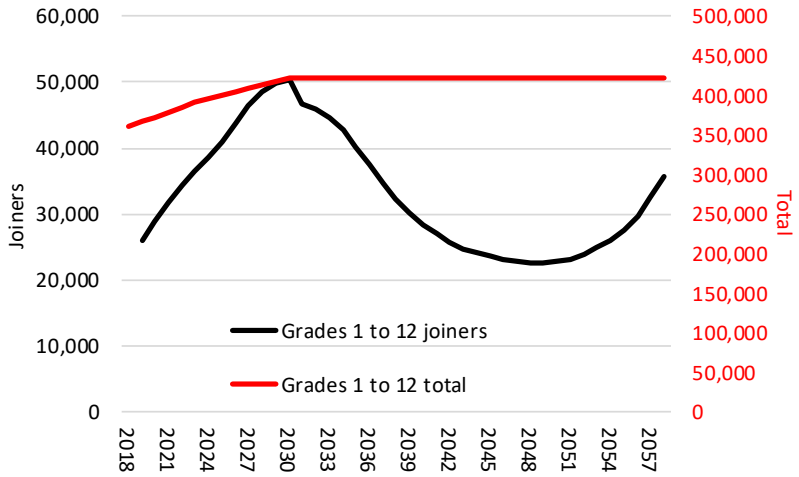


Figure 28 reflects the fact that 26,035 new teachers would have needed to join the publicly paid educator workforce in 2019. Around 4,000 of these were to cater for expected growth in the workforce between 2018 and 2019. This left around 22,000 joiners needed to replace those who left between 2018 and 2019. Is this roughly how many new teachers join each year currently? An unpublished 2020 DBE report (DBE, 2020, p. 6; see also DBE, 2009) states that in 2018 around 21,000 new teachers joined, while in 2019 around 25,000 did so. The baseline joiner level in Figure 28 can thus be said to pass a reality check. However, what should be made clear is that among the, say, 25,000 actual joiners in 2019, many were relatively old. Specifically, around 40% were older than 30 years on entering the public workforce.

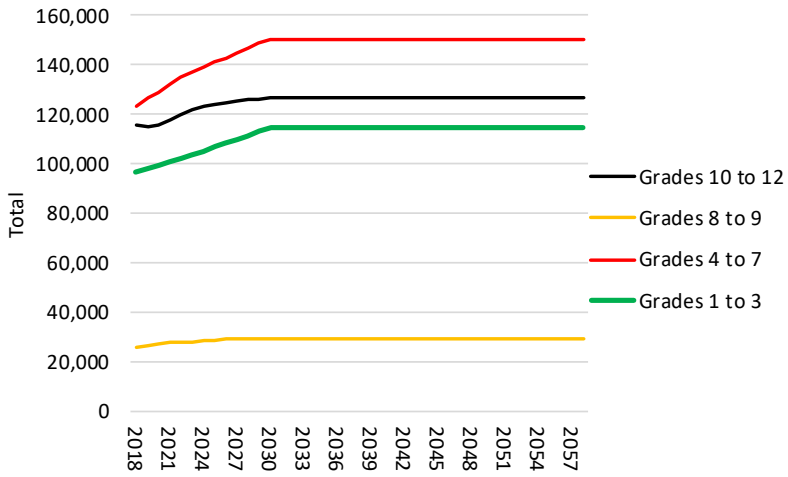
For planning purposes, the absolutely key issue is that the demand for joiners increases continuously and steeply up to 2030, reaching around 50,000 in that year, before declining for the following 20 or so years. Beyond around 2050, there is again an increase. Why is there so much fluctuation? This is due to the rather irregular age distribution patterns in the South African educator workforce (see Figure

26). Retirement of a large peak of older educators, which has already begun, increases the need for new joiners. However, after this peak has left the system and has been replaced by younger teachers, the need for new joiners actually declines because younger teachers experience only non-retirement attrition, not retirement attrition. Eventually the new peak of younger teachers ages and begins retiring, producing a new rise in the demand for joiners beyond 2050. What all this means is that capacity to produce new teachers must continue to grow for many years, to around 2030, but this growth should ideally be realised in ways that will allow for the scaling back of pre-service training beyond 2030. The magnitudes of the upscaling and downscaling are enormous. As Figure 28 makes clear, annual graduations of new teachers must double between now and 2030 and must then be cut in half over the following 20 years.

In one respect, the current scenario is not a BAU one. It is assumed that the LE ratios at the primary level would decline to 28:1 by 2030, against the current levels of around 33:1 (see the justification for this in Section 3.4.2). The reason why the total demand curve is horizontal beyond 2030 is simply that the available enrolment projections only go as far as 2030. Beyond that, no change in enrolments is envisaged. The modelling beyond 2030 is thus only interesting insofar as it relates to changing levels of teacher attrition, and thus changing levels of required joiners.

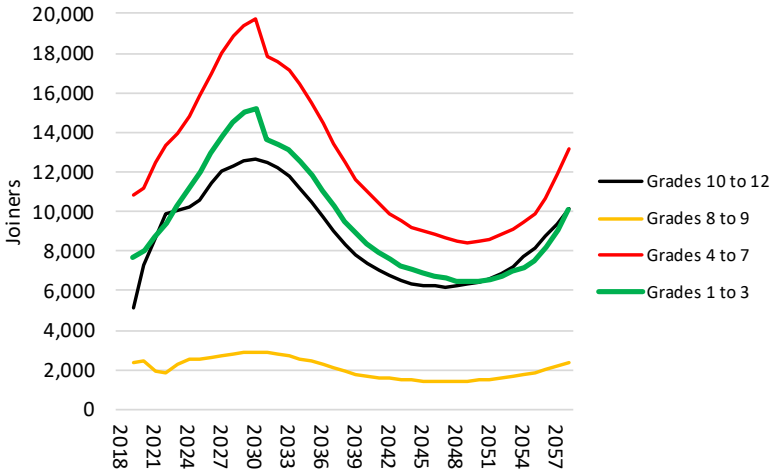
The two graphs below show breakdowns for the four levels of teachers described in Section 4.2. Increases and decreases are similar at the four levels. It should be remembered that the Grade 8 to 9 levels are low because so many teachers who teach Grade 8 to 9 learners are also qualified to teach in Grades 10 to 12 and would, therefore, be captured in the Grade 10 to 12 curves.

Figure 29: Total demand by level



Note: For the two levels in Grades 8 to 12, curves represent not who teaches particular grades, but full-time equivalent teachers with some specialisation at that level. The Grade 8 to 9 curve is low because Grades 8 to 9 are taught to a large extent by teachers who have qualified to teach Grades 10 to 12.

Figure 30: Joiners by level



See note for Figure 29.

4.3.2 Five scenarios compared

The scenario already described in Section 4.3.1 above is Scenario A, reflected in Table 22 below. It is compared to four other scenarios. Scenario B removes the lower LE ratios envisaged by 2030. In a way, Scenario B is most 'BAU'. However, insofar as reducing class sizes and LE ratios is a priority of the schooling system, Scenario A reflects the current policies best and has therefore been labelled 'BAU'. Clearly, Scenario B requires fewer teachers, both in terms of the total and annual joiners, by 2030. Scenario C changes the enrolment scenario to one where dropping out is reduced – this is a clear policy priority – but grade repetition is not – reducing grade repetition is arguably not as strong a priority in existing policies compared to reducing dropping out (see Section 3.1 on enrolment scenarios). Scenario C is the most costly of all in terms of teacher demand. Scenario D assumes that dropping out is reduced, but also that grade repetition is reduced. The lower numbers in this scenario underline the importance of improving the quality of schooling, which is a key prerequisite for reducing repetition levels.

Table 22: Five scenarios compared

	Scenario description	Total joiners needed in 2030	Total demand 2030	Identifier in Excel file name
A	Largely business as usual	50,445	421,010	BAU
B	'A' with no reduction in LE ratios	42,661	382,868	BAU static LE
C	'A' with fewer learners dropping out	53,171	444,412	BAU same R low D
D	'C' with less grade repetition	42,990	391,962	BAU low R low D
E	'A' with strong prioritisation of Grades 10 to 12 technical subjects	51,398	426,024	BAU technical

Scenario E is the only scenario which uses subject-specific prioritisation. Specifically, seven technical subjects, which have historically displayed large inequalities with respect to participation by population group, are prioritised (see Table 6). They are prioritised in a manner which ensures that by 2035 the

system as a whole displays levels of participation currently only seen amongst white learners. The seven subjects are: Civil Technology, Computer Applications Technology, Design, Electrical Technology, Engineering Graphics and Design, Information Tech ology and Mechanical Technology. Scenario E is rather costly. It increases the demand by around 5,000 teachers relative to Scenario A, and annual joiners in 2030 increase by around 1,000.

Table 23 provides a breakdown of envisaged changes in the demand for subject-specific teachers, drawing from Scenario E. In terms of joiners, the total for the technical subjects increases fifteen-fold, from 208 in 2019 to 3,073 in 2030.

Table 23: Technical teachers qualified for Grades 10 to 12

	Total 2018	Total 2030	Joiners 2019	Joiners 2030
Civil Technology	587	1,901	26	302
Computer Applications Technology	1,314	5,801	58	968
Design	48	302	2	53
Electrical Technology	293	549	13	75
Engineering Graphics and Design	1,877	8,004	83	1,330
Information Technology	141	930	6	162
Mechanical Technology	469	1,210	21	183
Total of above	4,729	18,698	208	3,073
All other subjects	111,012	96,168	4,894	10,505
Grand total	**115,741**	**114,866**	**5,102**	**13,577**

It is, of course, possible to generate many more scenarios. For instance, one could attempt to achieve a scenario with the lowest possible cost. This would be Scenarios B and D combined, which would result in a 2030 joiner figure of 36,098. This is a scenario which might need to be pursued in a context of extreme teacher supply constraints.

Figure 31: Total demand in five scenarios

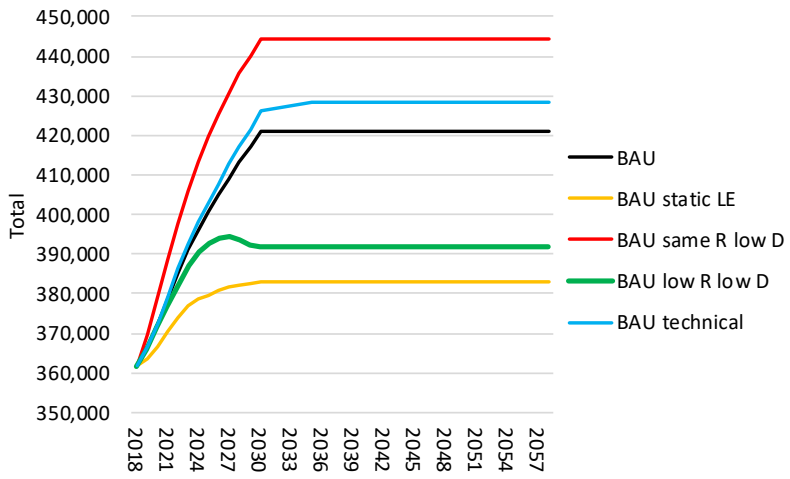
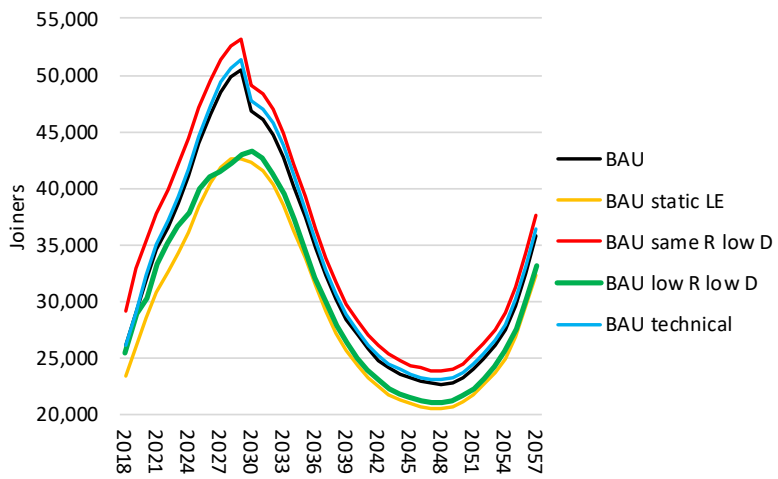
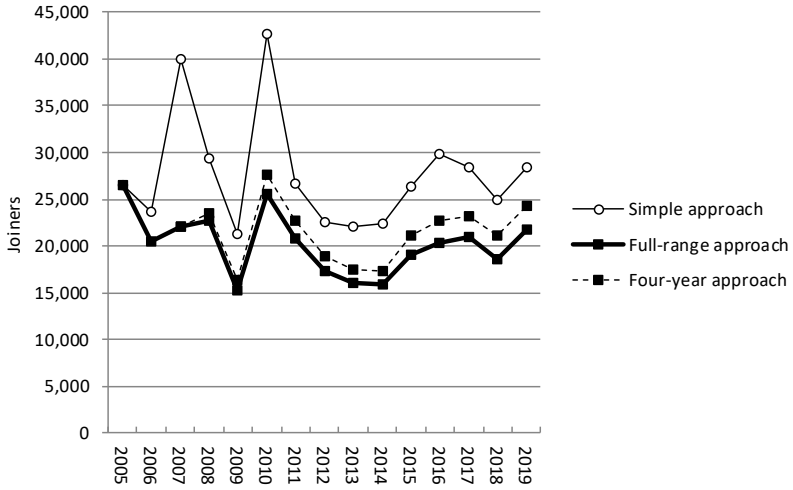


Figure 32: Joiners in five scenarios



The extreme increases in teacher demand for 2018 to 2030 reflected in Figure 32 raise the question as to whether comparable increases have been seen in the years leading up to 2018. Such sharp increases could not suddenly begin in 2018. Figure 33 below is copied from the 2020 DBE report discussed previously. Here the increased demand has been around an additional 800 each year in the 2014 to 2018 period. This should be seen against the fact that the total number of educators in PERSAL *declined by around 2,400 a year* between 2014 and 2018. Against this background, the annual rise in demand of at least 2,000 for 2018 to 2030 seen in Figure 32 is easily credible.

Figure 33: Actual joiners based on analysis of PERSAL data



Source: DBE, 2020

4.4 A reality check against university targets

The DHET's 2014 statement on student enrolment planning (2014, p. 22) refers to an 'undergraduate output' for 'teacher education' of 13, 735 in 2012, and envisages that this figure will rise to 23, 511 in 2019. For education as a 'major field of study', the number of graduates in 2012 is given as 35,477,

while the number of enrolments is 168,609 – these two figures provide a ratio of 4.75:1 (this ratio cannot be calculated for teacher trainees as enrolments for this category are not provided). Of relevance to satisfying the demands of the schooling system, the first set of figures is of importance: the undergraduate output for teacher education.

A 2017 DHET report (DHET, 2017, pp. 29-30) with figures which differ somewhat from the 2014 DHET statement states that the 2015 target for 'teacher education graduates' was 18,315, and that actual achievement was 19,124 in 2014 and 29,329 in 2015 – this latter figure, if it is correct, represents a huge increase on the corresponding statistic for 2014 and exceeds the target set for 2019. Half of this increase can be accounted for by the increase in graduates from the University of South Africa (Unisa), whose share of all graduates rose from 36% to 40% between 2014 and 2015. DHET officials have advised that the most reliable statistics are those that appear in the *Annual Performance Plan (APP)*[22] and *Annual Report of the DHET*[23] for the indicator 'Graduates in initial teacher education from universities'. Recent versions of those two documents provide the following numbers:

Table 24: Official teacher graduate figures by academic year

	2014	2015	2016	2017
Annual Report 2017/18	20,698	20,800	22,123	N/A
Annual Performance Plan 2018/19	N/A	N/A	22,123	22,780

N/A – not available

The APP of 2018/19, moreover, has a 2018 target of 99,000 teachers. This, DHET officials say, is a cumulative target for the enrolment plan, rather than the output in a specific year.

How easy would it be to supply the numbers of teachers arrived at in Section 4.3 given the capacity of the university system as seen in the statistics presented here? According to Figure 32, if demand remained at the 2018 level for a number of years, it would be feasible for supply to meet demand. In 2018, the most conservative demand scenario specifies a demand of 23, 000. The most recent actual supply figure of 22,780 in Table 24 suggests that this level of demand could be met. *The big problem, however, is that demand is expected to increase sharply in coming years.* The analysis in the foregoing sections makes it clear that the key factor behind this phenomenon is a surge in the number of retirements. This surge results in an increase in demand of at least 2,000 teachers per year for the period up to 2030. Thereafter, demand begins to fall as abruptly as it has increased.

The DHET has previously signalled the need for large increases in teacher supply. The 2014 official statement referred to previously mentioned an annual rise in the output of graduates of around 1,400 – this was for the period 2012 to 2020. An annual increase of 2,000 is considerably larger than this, yet not so large that it appears to be impossible.

22 https://www.dhet.gov.za/SitePages/DocStrategicPlans.aspx?RootFolder=%2FStrategic%20Plans%2FAnnual%20Perfomance%20Plans&FolderCTID=0x012000022A0F1F4E803449B8A86D7466668287&View=%7BC069603C%2DEC0F%2D-4382%2DAA44%2DCEE9219FFC75%7D

23 https://www.dhet.gov.za/SitePages/Reports.aspx

A key limitation of the current discussion is, of course, that it does not take into account the fact that many teacher graduates emerging from universities seek employment outside of the publicly employed teacher profession.

Clearly, the post-2018 ramping up of supply needs to be seen in the context of the post-2030 rapid *decline* in demand. One is thus dealing with a surge in demand which will pass after a couple of decades. This has implications for how the increased supply is managed. By 2048, demand will actually be *lower* than it is at present.

5 Teacher demand outside the core focus area

This section deals with teacher demand in the areas referred to in this report as 'non-core' areas: pre-Grade 1 education, independent schools (which may or may not be publicly funded), privately paid teachers in public schools, and special needs education. These non-core areas are, of course, important. However, they do not lend themselves to integration within the main teacher demand model, partly because of data constraints.

Table 25 below captures both the 'core', specifically the BAU scenario described earlier, and the 'non-core'. At pre-Grade 1 level, a distinction can be made between Grade R in public primary schools and education being provided outside these schools in pre-school institutions. There has been a stronger focus on minimum qualifications for the first group relative to the second group. Grade R enrolments in public ordinary schools are easy to establish as they are published in the DBE's *School Realities*[24] report. In 2018, the figure was 772,495. What is less easy to gauge is how many teachers in public ordinary schools teach Grade R. This is because of the way in which data has been collected from schools (Gustafsson, 2016, p. 40). It has been estimated that the LE ratio in Grade R in public schools is 37 (Gustafsson, 2017), which generates the figure of 20,878 Grade R educators seen in the table. It is assumed that this will not change substantially in the years to 2030. Turning to teachers, or what are often called 'practitioners', working outside of primary schools, there has been considerable confusion regarding the size of this sector. Africa Check recently confirmed that around 2.4 million South African children attended some form of pre-school in 2016[25]. While there was substantial growth in this number before 2016, household data point to levels of participation having remained fairly constant since then. It has been estimated using various sources that there is one teacher for every 22.4 children in this sector (Gustafsson, 2017). This lies behind the 107,143 value provided for 2018 in the table. It is assumed that the pre-school sector will grow by 350,000 children by 2030. This is roughly what would be needed to comply with the NDPs, universal coverage of not just Grade R, but also a year prior to Grade R (Gustafsson, 2018b). This produces 122,768 pre-school teachers in 2030 (again, a child-teacher ratio of 22.4 is assumed).

24 https://www.education.gov.za/EMIS/StatisticalPublications/tabid/462/Default.aspx

25 Page titled 'State of the Facts: Verifying Cyril Ramaphosa's #SONA2019 claims' at https://africacheck.org/reports/state-of-the-facts-verifying-ramaphosas-sona2019-claims. See also Gustafsson, 2018b.

Table 25: Total teacher demand in South Africa

	Total 2018	Total 2030	Joiners 2019	Joiners 2030
Pre-Grade 1 education	128,021	143,646	8,730	17,195
Grade R in schools	20,878	20,878	1,211	2,310
Pre-school institutions	107,143	122,768	7,519	14,885
Grades 1 to 12	439,287	498,642	30,540	59,034
Independent schools	38,660	38,660	2,243	4,277
Privately paid teachers in public schools	29,000	29,000	1,683	3,209
Special needs education	9,972	9,972	579	1,103
Core BAU demand	361,655	421,010	26,035	50,445
Grand total	**567,308**	**642,288**	**39,270**	**76,229**

Turning to Grades 1 to 12, the number of independent school teachers is published in *School Realities,* and is assumed to remain constant. Section 4.3.1 above referred to there being around 29,000 privately paid teachers for Grades 1 to 12 in public schools. This group was assumed to remain the same size until 2030. Public special schools employ just under 10,000 educators, according to the DBE's *Education Statistics in South Africa 2016* (DBE, 2018).

To estimate annual joiner figures, the following equation was used. Here *a* is the attrition rate – 5.8% for 2019 and 11.1% for 2030 were used, based on what was seen as the main 'core' model. The equation thus adds joiners needed to replace departing teachers and additional teachers needed to deal with sectoral growth in one year. Using an increasing attrition rate assumes that the bulge of older employees nearing retirement also exists in the 'non-core' groups.

$$TJ_Y = T_Y \times a_Y + \frac{T_{Y=2030} - T_{Y=2018}}{2030 - 2018}$$

By 2030, the country should produce 17,195 new pre-Grade 1 teachers a year, and 59,034 teachers for Grades 1 to 12, just to satisfy the demand from education institutions. Obviously, what also needs to be considered is the fact that some people graduate as qualified teachers and then do not teach at an educational institution in South Africa. They may work in a different occupation or they may become an educator outside the country. Similarly, what the totals in Table 25 do not take into account is the immigration of teachers from abroad.

PART 1: APPENDIX

Table A1: District codes used in maps

Prov.	District name	Code
EC	Alfred Nzo East	NE
EC	Alfred Nzo West	NW
EC	Amathole East	AE
EC	Amathole West	AW
EC	Buffalo City	BC
EC	Chris Hani East	HE
EC	Chris Hani West	HW
EC	Joe Gqabi	JG
EC	Nelson Mandela	NM
EC	OR Tambo Coastal	TC
EC	OR Tambo Inland	TI
EC	Sarah Baartman	SB
FS	Fezile Dabi	FE
FS	Lejweleputswa	LP
FS	Motheo	MH
FS	Thabo Mofutsanyana	TH
FS	Xhariep	XH
GP	Ekurhuleni North	EN
GP	Ekurhuleni South	ES
GP	Gauteng East	GE
GP	Gauteng North	GN
GP	Gauteng West	GW
GP	Johannesburg Central	JC
GP	Johannesburg East	JE
GP	Johannesburg North	JN
GP	Johannesburg South	JS
GP	Johannesburg West	JW
GP	Sedibeng East	SE
GP	Sedibeng West	SW
GP	Tshwane North	TN
GP	Tshwane South	TS
GP	Tshwane West	TW
KN	Amajuba	AM
KN	Harry Gwala	HG
KN	Ilembe	IL
KN	Pinetown	PI
KN	Ugu	UG
KN	Umgungundlovu	UM
KN	Umkhanyakude	UK
KN	Umlazi	UL
KN	Umzinyathi	UY
KN	Uthukela	UT
KN	Uthungulu	UU
KN	Zululand	ZU
LP	Capricorn	CA
LP	Greater Sekhukhune	SK
LP	Mopani	MP
LP	Vhembe	VH
LP	Waterberg	WA
MP	Bohlabela	BO
MP	Ehlanzeni	EH
MP	Gert Sibande	GS
MP	Nkangala	NK
NC	Frances Baard	FR
NC	John Taolo Gaetsewe	JO
NC	Namakwa	NA

Prov.	District name	Code
NC	Pixley ka Seme	PS
NC	ZF Mgcawu	ZM
NW	Bojanala Platinum	BJ
NW	Dr Kenneth Kaunda	KE
NW	Dr Ruth Segomotsi Mompati	RU
NW	Ngaka Modiri Molema	NG
WC	Cape Winelands	CW
WC	Eden and Central Karoo	ED
WC	Metro Central	MC
WC	Metro East	ME
WC	Metro North	MN
WC	Metro South	MS
WC	Overberg	OV
WC	West Coast	WE

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PART 2:

THE SUPPLY OF TEACHERS IN SOUTH AFRICA

Servaas van der Berg
Cobus Burger
Martin Gustafsson

Part 2 Executive summary

While the first part of the report focused on the demand for teachers, this part of the report focuses on teacher supply. The need for such analyses derives from concern that not enough teachers are being trained to meet future needs. This concern has also led to earlier efforts to evaluate the situation.

What makes this study of the supply of teachers unique is that it includes an analysis of a data set that has never before been available, namely, the data of individuals that was matched and merged across data from matriculation examinations, the Higher Education Management Information Systems (HEMIS) and the Government Personnel and Salary System (PERSAL) (for all teachers) to understand the flows of teachers into PERSAL so as to inform education policy. The merging of the data was done for this study by the DHET, due to privacy concerns. The matching worked well, and it appears that there were few cases where incorrect matching took place or where persons appearing in two consecutive datasets were not matched. The data nevertheless still has some limitations. The main one is that although the time period over which individuals could be tracked was quite long (from 2008 to 2017), complete tracking could still not be done in cases where some individuals were still perhaps *en route* to joining PERSAL. The reasons for this are that not all matriculants immediately enter university, that many students take a long time to complete their studies, that some continue with additional graduate studies and that not all who complete their studies and join PERSAL do so without delay.

An important metric to consider when estimating teacher supply is the rate at which teachers leave the teaching profession, that is, the attrition rate. Estimates from earlier research suggest that there has been great fluctuation in the attrition rate of teachers over the last two decades. Estimates from Crouch (2001) show that the attrition rate was 5.5% in 1998, and estimates in a study completed for the Education Labour Relations Council (2005) suggest that the attrition rate had increased to 5.9% by 2003. The next five years saw the teacher attrition rate decrease sharply to just over 3% per year. The teacher attrition rate returned to pre-2004 levels (5%) in the period 2011 to 2013, and almost doubled to 9% in 2014 (Gustafsson, 2020, p. 42, Figure 24).

Another important metric when estimating teacher supply is the joining rate, that is, the new teachers joining PERSAL in a given year, expressed relative to the number of teachers before adding the joiners. Gustafsson (2018) showed that the largest movement of teachers in public schools was into non-permanent positions: out of almost 22 000 teachers that joined PERSAL in 2012, only 2 700 (12%) were initially permanently appointed. Part 1 attributes much of the fluctuation in teacher attrition rates to changes in the number of temporary posts.

Comparing the joining rate with the attrition rate provides an idea of how the size of the teacher workforce changed in a given year.

Discrepancies between the number of initial teacher education (ITE) graduates and teachers entering PERSAL arise since not all new ITE graduates enter the profession upon graduating.

Van Broekhuizen (2015, pp. 31-2) explains this as follows:

> *Each new group of ITE graduates effectively includes some individuals who are already employed as teachers, some who have no intention of seeking employment as teachers or at least not to do so in the immediate future, some who seek to become teachers, but cannot find employment despite applying for teaching posts, and some who both want to work as teachers and are able to find suitable positions in which they are subsequently employed.*

TEACHERS IN PERSAL

From the data available for this report, overall movement both into and out of PERSAL was about 3.6% per year in 2012: 3.6% left PERSAL in 2010 and 3.6% joined in 2012. Generally, differences between provinces are not very great. Movement between schools tended to be towards urban areas. Relatedly, there is evidence that teachers who moved tended to move to better-performing schools.

The need for greater teacher production has long been recognised. The *Integrated Strategic Planning Framework for Teacher Education and Development 2011-2025* (DBE & DHET, 2011) found that only 5,942 new teachers had graduated from universities in 2009, including 1,275 Foundation Phase teachers and 2,949 Further Education and Training (FET) band teachers. The *Integrated Strategic Plan* mentioned a concerted drive to increase enrolment in teacher training, while expressing concern about attrition. Applying a 5% attrition rate, it was estimated that at least 20,000 teachers need to be replaced per year.

However, this did not consider another important feature of the supply of teachers, namely that a large proportion of teachers who leave the education system later return, and also that a large proportion of the seemingly 'new' supply of teachers arises from teachers returning to teaching. This makes measurement of real attrition as well as real new joiners difficult, unless data for all years is available. In this report, these problems cannot be fully overcome because only five years of PERSAL data is available.

This makes it complex to analyse flows through university starting at the school level and ending when an individual joins PERSAL, and to apply the findings to current cohorts of matriculants or new students entering university. Variation between years may often be minor, which would make it possible to draw fairly strong inferences across cohorts. But some magnitudes may be very volatile. For instance, the DHET's monitoring report on its enrolment planning (DHET, 2017, p. 30) indicates that the number of graduates from ITE programmes jumped from 19,124 in 2014 to 29,329 in 2015, while the *Trends in Teacher Education* report of 2020 (DHET, 2020, p. Tables 2 & 3) indicates that 28,203 students graduated from South African universities with a Bachelor of Education (BEd) (17,243) or with a Post-graduate Certificate in Education (PGCE) (10,960) in 2018. Such volatility may weaken the generalisability of inferences that can be drawn from such data.

Section 2 of this part of the report sets out the situation regarding the number of teachers in PERSAL, and also starts the discussion on teachers leaving PERSAL or of others joining, a theme that runs through the whole report. As there is a lot of churning in PERSAL (teachers who may leave one year and be back two years later), joining and exit rates are investigated over the full period that the HEMIS data allows, 2013-17. In addition, teachers in PERSAL in 2017 are analysed in terms of whether they were joiners or had been in PERSAL before.

Transitions into and out of PERSAL show quite large movements. Between 2013 and 2017, 117,000 teachers left PERSAL, and 115,000 joined. While other characteristics of the teacher corps appear quite stable, the age pattern and the nature of the transitions are interesting.

Though the overall age profile of teachers in PERSAL is quite stable over time, there is an age shift taking place. The number of teachers in the age category between 35 and 50 years is declining, while the proportions of younger and older teachers are increasing. The growth of the older group is of great pertinence to Part 1, as this seriously raises the rate of attrition through retirement, and therefore the required supply.

- We distinguish three large groups of teachers in our data:

- Those who matriculated from 2008 and then entered HEMIS and subsequently joined PERSAL (9,221). Three per cent of them have done so without completing their university qualification.
- Those who were observed in HEMIS and not in the matric data, which means that most of them had matriculated before 2008 (although some could have attended private schools that did not write the public school matric examination) (10,029). Amongst this group, 8% did not complete a university qualification.
- Those who were observed neither in the HEMIS data since 2010, nor in the matric data from 2008 (6,634). They had either studied at university before 2013 or, in a smaller number of cases, could have been students who had completed their university studies abroad, whether South African or foreign nationals.

TRACKING STUDENTS FROM MATRIC INTO UNIVERSITY

Section 3 discusses the findings from tracking students from school into university. In this section, the attention is mainly on the pipeline from school to teaching qualifications, but attention is also paid to the matric results of prospective teachers studying for a BEd degree, comparing their results in matric with those of students enrolling for other degrees, which may offer some hints about how competitive teaching students may be in the labour market.

Using the matric data (2008-2017) matched to HEMIS data (for 2010-2017) makes it possible to observe which students, and how many, enter university for degree studies. As not all students enter university immediately, allowing for the possibility that students only enter university in the third year after matric means that the 2013 matric cohort is the most recent one that can be tracked in HEMIS. Of the 565,000 matriculants of 2013, 25.2% enrolled in undergraduate degrees at university in the three years immediately following matriculation, with 10.5% of degree students enrolling in a BEd programmes.

Teaching is not universally regarded as an attractive profession. Salaries are often perceived to be relatively low (Gustafssson & Maponya, 2020) and promotion possibilities more constrained than in many other jobs. However, in South Africa, teacher salaries rose sharply in 2008 and have continued to rise since then; and some people, especially secondary earners in a household, find aspects of teachers' working conditions, such as school holidays, attractive. These considerations make it unclear to what extent good matric candidates would be attracted to the teaching profession. One way of evaluating that is to consider the matric results of BEd students and compare those to students who enrol for other degrees.

Matriculants enrolling for an education degree (BEd), although drawn from better performers who achieved a bachelor's pass, did not perform as well in matric as other students that enrolled for a degree. For students enrolling for other degrees, the average mark across matric subjects was 68%, while BEd students had obtained only 63%. The University of the Witwatersrand and the University of Pretoria had the largest differences, although the average matric mark of students who enrolled for a BEd in those two universities was quite high. Differences between BEd and other degree students were especially large in the proportion of students who elected to do Mathematics rather than Mathematical Literacy, and who then obtained at least 50% for Mathematics. This proportion was 54% for students studying other degrees, but only 20% for students enrolling for a BEd. In summary, then, students enrolling for a BEd have weaker matric results than students enrolling for other degrees, but the difference is especially stark in terms of the proportion who obtained a mark of at least 50% in Mathematics in matric.

TRACKING EDUCATION STUDENTS FROM SCHOOL THROUGH UNIVERSITY AND INTO PERSAL

Section 4 focuses on students who joined PERSAL in 2017. Three groups are distinguished: those who were in matric from 2008 onwards and also in HEMIS (typically younger joiners); those only observed in HEMIS and not in matric (somewhat older joiners, typically); and then those who were not observed in HEMIS since 2010 – these may be students who failed to enter teaching when they had completed their teacher studies and only now, many years later, entered PERSAL, or they could have been in PERSAL before 2013 (the earliest date of the PERSAL data), i.e. they could be returning teachers. These teachers are analysed according to some of their other attributes.

To understand the supply of teachers, it is important to know how many students receive qualifications that would allow them to become teachers. However, once students qualify to become teachers, it does not automatically follow that they enter PERSAL and become public service teachers. Students face a number of alternatives at this point:

- Some may spend more time at university, doing post-graduate studies;
- Others may take a gap year, perhaps teaching overseas;
- Some may start teaching immediately, but not as publicly remunerated teachers in public schools: they could teach in private schools, or fill School Governing Body (SGB) positions in public schools;
- Many students may end up in jobs other than teaching.

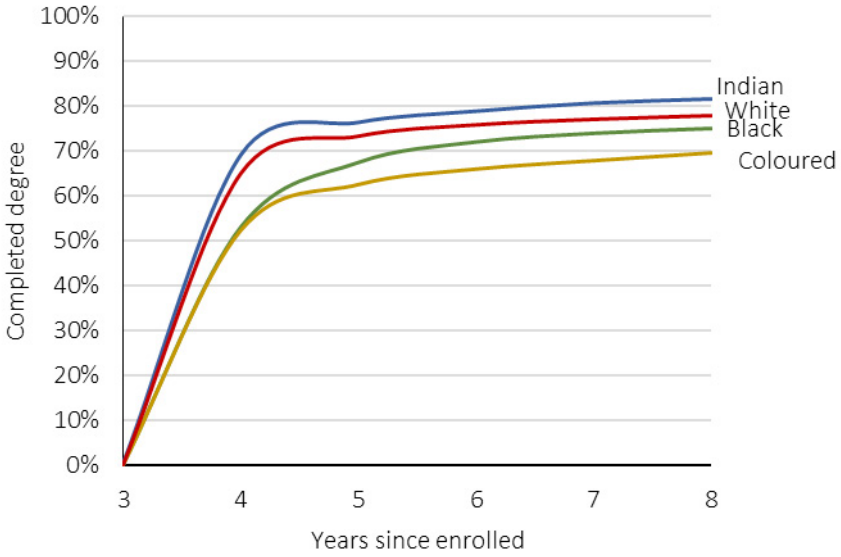
As they are the most important teaching qualifications, the focus falls on the BEd and PGCE.

BEd students

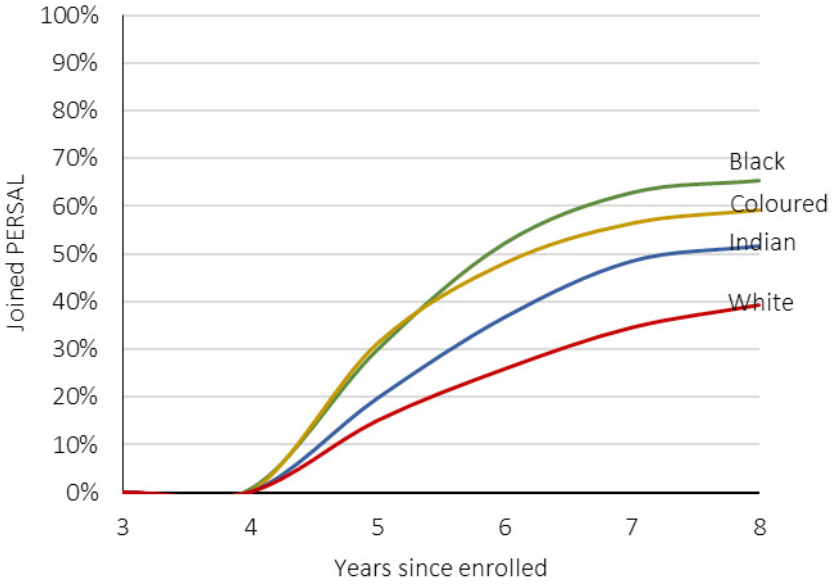
The majority (57%) of full-time BEd students completed their degrees in the minimum four years. However, this aggregate result masks important differences across population groups, as the figures below show. Notably, there is roughly a 10 percentage point difference between the proportions of black African and coloured students who did so on the one hand, and proportions of white and Indian students who did so on the other hand. At the end of eight years, 78% of students had graduated. Most of the other 22% had dropped out.

The figures show the proportion of full-time BEd students who graduated (on the left) and those who graduated and joined PERSAL (on the right). It is clear that many full-time BEd graduates did not enter the teaching profession after graduating. For example, only 25% of the initial group of students who had enrolled in full-time BEd degrees had joined PERSAL in their fifth year. This is surprising, considering that 57% of these students had already completed their BEd degrees in the previous year. Even by Year 8, only just over half (54%) of students who had started full-time BEd studies had graduated and joined PERSAL. For white and Indian students, there was a far greater decline between completing their degrees in year seven and joining PERSAL. This is consistent with the suggestion that many joined private schools or obtained SGB positions in public schools.

Top panel: Cumulative percentage of 2010-2011 first time entering full-time BEd students that completed degree by population group and year;



Lower panel: Cumulative percentage of 2010-2011 first-time entering full-time BEd students that completed degree and joined PERSAL by population group and year



Flow-through rates among part-time BEd students are much slower. Fewer than half (47 %) of University of South Africa (Unisa) BEd students had completed their degrees by the end of Year 8. This proportion was also low for Northwest University, at 64 %. Many Unisa BEd graduates did not join PERSAL; while 39% had graduated by the end of Year 6, only 19% had joined PERSAL two years later, i.e. about half of graduates. A factor that may play a role here is that many part-time students may have obtained other (non-teaching) jobs while studying, and may have been reluctant to give up such jobs to enter the teaching profession, even though that may have been their original intent.

PGCE students

Many students that initially study non-teaching degrees enrol for a one-year PGCE after completing such degrees to qualify to become teachers. Full-time pass rates for this programme are high, with 94% of the 2014 cohort having obtained this qualification; yet, even in the fourth year after initial enrolment, only 65% ended up joining PERSAL. Amongst white students, this proportion was just 32%. About three-quarters of these PGCE students studied with the intention of teaching in the FET band, i.e. Grades 10 to 12. (DHET, 2020)

The flow-through rates for part-time PGCE students are much slower. Only 60% of part-time PGCE students had completed their degrees by Year 4 and only 31% had joined PERSAL.

Conclusion

Using a unique data set, this report shows some important features of the teacher supply situation that were not possible to ascertain previously without this data.

In particular, it is clear that there are large differentials in teacher flows through the university system, with part-time students and particularly Unisa students performing particularly poorly.

In addition, a large proportion of students do not, upon completion of their teaching studies, enter PERSAL. While some may enter the South African schooling system in another way (e.g. as teachers in private schools or SGB teachers in public schools), this does not account for all of the slippage between student graduations and joining PERSAL. More information is needed about these teachers and whether they form an important part of the ‘reserve teacher stock’

1 Introduction

1.1 Background to this research

The need for further analysis of teacher supply derives from concern that not enough teachers are being trained to meet future needs. This concern led to earlier efforts to evaluate the situation. One such effort culminated in a 2009 Teacher Summit Meeting that gave rise to the *Integrated Strategic Planning Framework for Teacher Education and Development 2011-2025*, which argued that there was

> *… both an absolute shortage of teachers, and a relative shortage of teachers qualified and competent enough to teach specific subjects or learning areas …*
>
> *in specific phases … in specific languages … in Special Needs schools, in ECD, and in rural and remote schools* (DBE & DHET, 2011, p. 11).

Subsequent research (discussed below) provided a clearer picture of what is happening generally in terms of teacher supply. This report focuses specifically on what can be learned from merged data sets of the matric examinations, Higher Education Management Information Systems (HEMIS) and PERSAL (the public sector payroll system). Merging the three data sets allows tracking of prospective teachers from matric through university and into the public schooling system. This kind of analysis can be used to understand features of teacher supply which could not previously be investigated, such as how many and which students enrol to study education qualifications at university, how they flow through university, with some dropping out and others taking longer to complete their studies, and how many of them eventually enter PERSAL to teach in the public school system.

1.2 Previous research on the supply of teachers

An important metric to consider when estimating teacher supply is the rate at which teachers leave the teaching profession, that is, the attrition rate. Estimates from earlier research suggest that there has been great fluctuation in the attrition rate of teachers over the last two decades. Crouch (2001) estimated that the 1998 attrition rate was 5.5% in 1998, while a study completed for the Education Labour Relations Council (2005) found that the attrition rate had increased to 5.9% by 2003. The five-year period 2004-2008 saw the teacher attrition rate decline sharply to just over 3% per year (Gustafsson, 2020, p. 42, Figure 24). The teacher attrition rate returned to pre-2004 levels in the period 2011 to 2013 (reaching 5 %), and in 2014 it almost doubled (reaching 9%) (Gustafsson, 2020, p. 42, Figure 24).

Another important metric to consider when estimating teacher supply is the joining rate, i.e. new teachers who join PERSAL in a given year, expressed relative to the number of teachers in the system before the joiners were added. Gustafsson (2018) showed that the largest movement of teachers in public schools was into non-permanent positions: out of almost 22,000 teachers who joined PERSAL in 2012, only 2,700 (12%) were initially permanently appointed. Over time, however, many temporary teachers are appointed in permanent positions: in 2012, 87% of 407,000 teachers who stayed in the public school system were in permanent positions. Gustafsson (2020) attributes much of the fluctuation in teacher attrition rates to changes in the number of temporary posts.

Comparing the joining rate with the attrition rate provides an idea of how the size of the teacher workforce has changed in any given year. For example, the teacher workforce shrunk by about 3,300 teachers in 2012, since 24,306 teachers left the profession, whereas 21,997 entered (Gustafsson, 2016, p. 66, Table 21). There is a discrepancy between the number of initial teacher education (ITE) graduates and

the number of teachers entering PERSAL because not all new ITE graduates enter the profession upon graduating. Van Broekhuizen (2015, pp. 31-2) explains the reasons behind this phenomenon as follows:

> *Each new group of ITE graduates effectively includes some individuals who are already employed as teachers, some who have no intention of seeking employment as teachers or at least not to do so in the immediate future, some who seek to become teachers, but cannot find employment despite applying for teaching posts, and some who both want to work as teachers and are able to find suitable positions in which they are subsequently employed.*

The data available for this report showed that overall movement into and out of PERSAL was 3.6% per year in 2012: 3.6% left in 2010 and 3.6% joined in 2012 (see Table 26). Generally, changes at a provincial level are slight, although the Eastern Cape lost 3.7% of its teachers over the period 2010 to 2012, and over the same period there were strong gains in Limpopo (4.8%) and in Mpumalanga (4.1%). Movement between schools tended to be towards schools in urban areas, as Figure 34 shows. As Gustafsson (2016, p. 68) states:

> *The general pattern seems to be one of movement towards more urban areas. Even within some provinces, there appears to be a movement towards provincial capitals, for instance in Limpopo and North West. In KwaZulu-Natal there appears to be a clear movement from the north to the south of the province.*

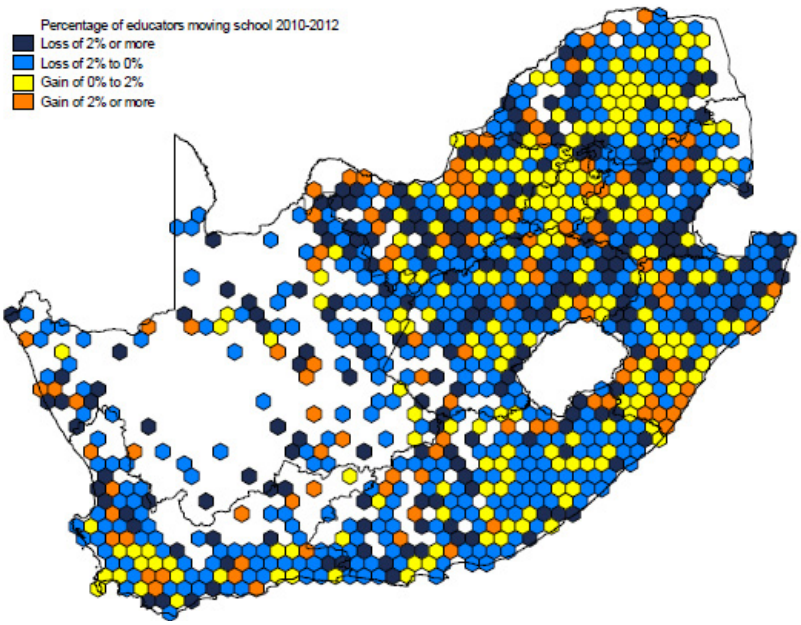
Relatedly, he found evidence that teachers who moved tended to move to better-performing schools. (Gustafsson, 2016, p. 71).

Table 26: Indicators of 2010 to 2012 movements

	Percentage leaving in 2010 (not re-appearing in 2011 or 2012)	Percentage moving school 2010-12	Percentage gain or loss 2011-12	Percentage gain or loss in permanent educators 2011-12	Percentage joining in 2012 (not in PERSAL in 2010 or 2011)	Average age in years, 2012
EC	3.5	-0.2	-5.8	-3.7	1.0	45.7
FS	3.6	0.0	1.9	0.1	5.6	44.9
GP	4.0	0.5	1.1	-0.6	5.8	44.8
KN	4.0	0.0	-1.7	0.5	4.1	42.4
LP	2.4	-0.1	4.2	4.8	1.5	46.8
MP	2.6	-0.2	0.3	4.1	3.1	45.3
NC	3.6	-0.4	1.2	-0.3	5.6	45.0
NW	3.0	-0.1	1.2	0.1	4.0	46.2
WC	5.1	0.1	-0.5	0.7	5.5	45.9
SA	3.6	0.0	-0.4	0.6	3.6	44.8

Source: Derived from Gustafsson (2016, p. 67, Table 22)

Figure 35: Between-school movement of educators, 2010-12



Source: Gustafsson (2016, p. 68, Figure 38)

The need for greater teacher production has been long recognised. The *Integrated Strategic Planning Framework for Teacher Education and Development 2011-2025* (referred to as 'the Plan') found that only 5,942 new teachers had graduated from universities in 2009, including 1,275 Foundation Phase teachers and 2,949 FET teachers. The Plan mentioned a concerted drive to increase enrolment in teacher training:

> *In the same year, due in part to an ongoing teacher recruitment campaign, 16 257 students enrolled for the first time in initial teacher education programmes, an increase of 37.1% over 2008. In 2009, about 9 000 student teachers were supported with full-cost Funza Lushaka bursaries, which target identified high priority or scarce subjects and phases* (DBE & DHET, 2011, p. 11).

In contrast with this seemingly positive picture, the Plan pointed to major attrition problems. It stated that the attrition rate had remained stable at around 5% to 6% per annum since 1994, and then applied a 5% attrition rate to the approximately 400,000 teachers at that time (including those in private schools) to conclude that

> *…a minimum of 20 000 teachers need to be replaced every year. For the Foundation Phase alone, there is a need for an annual replacement of 4 268 African mother-tongue teachers, 755 Afrikaans mother-tongue teachers and 453 English mother-tongue teachers (DBE & DHET, 2011, p. 12).*

However, this attrition rate does not take into account another important feature of the supply of teachers, and indeed also of teacher attrition, namely that a large proportion of teachers who leave the education system later return, and a large proportion of the seemingly 'new' supply of teachers is a consequence of teachers returning to teaching. This is explained by Gustafsson (2018, p. 2) as follows:

> *… analysis of the data indicated that 13.8% of the 565 309 people who were educators in the 2004 to 2013 period, entered the system more than once in the*

> *years 2005 to 2013, meaning they were absent in the previous year and present in the current year. The great majority of this multiple entry manifests itself in two entries. [Some] 12.9% of the 565 309 educators entered twice during the period in question. The phenomenon of multiple entry means that examining joining whilst using the data from just two consecutive years is likely to result in an over-estimation of the number of joiners.*

This issue makes measurement of real attrition as well as real new joiners difficult, unless data for all years is available. In this report, although five years of PERSAL data was available, these problems could not be fully overcome.

1.3 Data used for Part 2

Part 2 of this report uses data from three sources:

- Matriculation data sets for the years 2008 to 2018
- HEMIS data from 2010 to 2017
- PERSAL data for educators (teachers and principals) from 2013 to 2017.

Owing to privacy concerns, the data was merged on behalf of the research team by Mr Norman Nkwane of the DHET, and the individual identifiers were then removed before the team could start working on the data. The merging process involved matching and linking all the individuals who could be found in both data sets from the matric data to HEMIS, and similarly from PERSAL back to HEMIS. In principle, that would enable a researcher to track someone from school into university and from there into PERSAL. The only previous study which is comparable was one that utilised data to track matriculants into HEMIS, but not into PERSAL. (Van Broekhuizen, Van der Berg, & Hofmeyr, 2016).

The matching process worked well. It appears that there were few cases where incorrect matching occurred or where individuals who appeared in consecutive data sets were not matched. The data nevertheless had some limitations. The main limitation was that although the time period over which individuals could be tracked was relatively long (from 2008 to 2017), complete tracking could nevertheless not be done in cases where some individuals were still perhaps *en route* to joining PERSAL. The reasons for this are that not all matriculants enrol immediately for university studies – in fact, many take another year or even two years to enter university; furthermore, many students spend a number of years studying before they are able to complete a degree or another qualification, and this time period is particularly protracted for part-time students; and some graduates may continue with post-graduate studies. In addition, not all those who complete their studies and join PERSAL do so without some form of delay.

These factors make it difficult to analyse flows through the university system, starting at school level and ending when an individual joins PERSAL, and to apply the findings of such research to current cohorts of matriculants or new students entering university. The variation between years may often be minor, which would make it possible to draw fairly strong inferences from such findings across cohorts. However, sometimes change between one year and a subsequent year appears very volatile; for instance, the DHET's monitoring report on enrolment planning (DHET, 2017, p. 30) stated that the number of graduates from ITE programmes increased rapidly from 19,124 in 2014 to 29,329 in 2015, while the *Trends in Teacher Education* report of 2020 (DHET, 2020, Tables 2 & 3) indicates that 28,203 students graduated from South African universities with a BEd (17,243) or with a PGCE (10,960) in 2018. Such volatility may weaken the generalisability of inferences that can be drawn from such data.

1.4 Contents of Part 2

Section 2 of Part 2 describes the situation regarding the total numbers of teachers in PERSAL, and initiates the discussion on teachers leaving or joining PERSAL, a theme that also runs through Parts 1 and 3 of the report. As there is a lot of churning in PERSAL (teachers who leave in one year and return within the two subsequent years), joining and exit rates are investigated over the full period that the HEMIS data set allows, i.e. 2013-17. In addition, teachers in PERSAL in 2017 are analysed in terms of whether they were joiners or whether they had been previously been in PERSAL.

Section 3 discusses the findings arising from tracking students from school into university. In this section, the primary focus is on the pipeline from school to teaching qualifications, but attention is also paid to comparing the matric results of prospective teachers studying for a BEd degree with those of students enrolling for other degrees. The comparison may offer some insight into how competitive teaching students may be in the labour market.

Section 4 focuses on students who joined PERSAL in 2017, distinguishing them by whether, in HEMIS, they studied in the period 2010-2017, and whether they were observed in matric in 2008 or in subsequent years. Three groups are differentiated: those who were in matric from 2008 onwards and also in HEMIS (typically younger joiners), those only observed in HEMIS and not in matric (typically somewhat older joiners) and those who were not observed in HEMIS since 2010 – these may be students who failed to enter teaching when they had completed their teaching studies and who entered PERSAL some years later, or they could have been in PERSAL before 2013 (the earliest date of the PERSAL data), i.e. they could be returning teachers. These teachers are then analysed in terms of other attributes.

Section 5 briefly concludes. With that the scene is set for Part 3 on the Demand and Supply of teachers, which is where some important policy questions are asked.

2 Teachers in PERSAL

2.1 Total number of teachers in PERSAL, 2013 to 2017[26]

Table 27 shows that there was stability in the characteristics of the teacher population captured in PERSAL between 2013 and 2017. The total number of teachers in PERSAL hardly changed, and both the population group and gender composition of teachers was quite stable over this period, with black Africans making up 81% of teachers in 2017, and more than two-thirds (69%) of teachers being women. This stability also extended to the provinces. KwaZulu-Natal employed the largest number of teachers, about 88,000 teachers in 2017, followed by Gauteng (60,000), and the Eastern Cape (52,000). The lower panel of the table shows that around 202,000 teachers were in primary schools, compared with 136,000 secondary school teachers, with fewer teachers in combined or intermediate schools.

26 As data for Limpopo was missing for 2013, 2014 was used to approximate the 2013 numbers. In some of the raw data there was a disproportionate number of Adult Education teachers, thus all Adult Education institutions were dropped. In an attempt to exclude non-teachers, everyone who had missing information on qualifications in PERSAL was dropped from the sample.

Table 27: Teachers[27] by gender, population group, province and school type

	Numbers					%
	2013	2014	2015	2016	2017	2017
Female	253 060	252,816	250,244	252,250	254,881	69%
Male	116,767	115,464	112,543	112,249	112,199	31%
Black	300,042	298,089	292,821	294,876	297,628	81%
Coloured	26,732	26,825	26,702	26,593	26,739	7%
Indian	10,550	10,505	10,366	10,362	10,274	3%
White	32,503	32,861	32,898	32,668	32,439	9%
EC	58,530	56,163	52,886	52,238	52,083	14%
FS	21,288	20,455	19,953	19,829	19,590	5%
GP	55,141	56,172	57,001	58,665	60,400	16%
KZN	87,988	88,266	87,655	88,893	88,497	24%
LP	54,299	54,299	52,682	51,029	51,426	14%
MP	32,227	32,286	32,232	32,661	32,845	9%
NC	8,616	8,686	8,687	8,801	9,077	2%
NW	24,570	24,435	23,637	24,194	24,634	7%
WC	27,168	27,518	28,054	28,189	28,528	8%
Primary	198,683	198,627	197,087	199,169	202,144	55%
Secondary	138,676	138,242	136,169	136,350	136,273	37%
Combined	23,034	22,570	21,307	20,864	20,593	6%
Intermediate	9,434	8,841	8,224	8,116	8,070	2%
Total	**369,827**	**368,280**	**362,787**	**364,499**	**367,080**	**100%**

Some 26% of teachers spoke isiZulu as their home language, 16% spoke isiXhosa, 11% spoke Afrikaans, and only 9% spoke English, which is nevertheless the dominant language of learning and teaching (LOLT) from Grade 4 onwards (Table 28). When the home languages of children aged 6 to 18 years (the likely learners) were compared to the home languages of teachers, teachers with English as their home language were over-represented in PERSAL by three percentage points, whereas teachers with isiXhosa or Sepedi as their home language were both under-represented by about three percentage points (Figure 35).

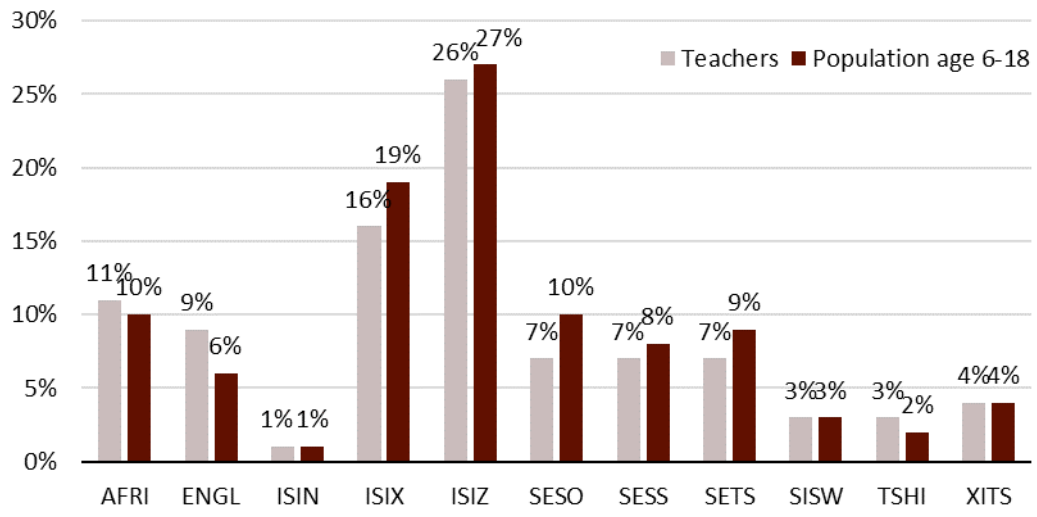
27 'Teachers' or educators are defined for this purpose as personnel involved in teaching at a public ordinary school, including principals, deputy principals and other teaching staff.

Table 28: Teachers by home language

	Numbers					%	Population aged 6-18, 2016
	2013	2014	2015	2016	2017	2017	
Afrikaans	39,533	40,197	40,305	40,131	40,279	11%	10%
English	33,232	32,348	32,247	33,587	33,810	9%	6%
isiNdebele	3,373	3,270	3,266	3,454	3,545	1%	1%
isiXhosa	61,306	58,986	56,589	57,361	57,898	16%	19%
isiZulu	92,485	95,211	95,021	94,868	95,842	26%	27%
Sepedi	26,059	25,745	25,520	26,195	26,777	7%	10%
Sesotho	30,458	30,181	29,134	27,432	27,250	7%	8%
Setswana	27,622	28,359	27,448	26,470	26,622	7%	9%
siSwati	8,726	9,224	9,326	9,286	9,447	3%	3%
Tshivenda	11,033	10,770	10,530	10,957	11,119	3%	2%
Xitsonga	15,187	14,847	14,679	15,058	15,285	4%	4%
Other	14,665	13,075	12,662	14,817	14,826	4%	0%
Unknown	6,148	6,067	6,060	4,883	4,380	1%	0%
Total	**369,827**	**368,280**	**362,787**	**364,499**	**367,080**	**100%**	**100%**

Source of population data: Community Survey 2016

Figure 36: Teachers and learners by home language



As Figure 36 shows, the age profile of teachers over time also seems quite stable, with the profile moving slowly to the right each year, as teachers age. The major changes appear at lower age levels, through new teachers joining, and at the top end of the age distribution, as teachers aged and approached retirement. Table 29 shows that these were actually quite major structural shifts. Between 2013 and

2017, the proportion of teachers below 35 years of age increased substantially, from 12% to 19%. Over the same period, the proportion of teachers who were 50 years of age or older increased from 33% to 39%. The latter group is the one that will play a large role in attrition in the coming decade. In contrast, between 2013 and 2017, the proportion of teachers in the age group 35 to 49 years declined sharply, from 56% to 42%, a loss of 52,000 teachers in this age group. Figure 37 shows the total increase or decrease in numbers of teachers at each age level between 2013 and 2017. The changes reflected in Figure 38 broadly confirm these findings: the number of teachers aged 36 to 46 years declined sharply, while there were large increases in the numbers of teachers in the youngest and oldest age categories. For further details, see the teacher age data in Appendix Table 1.

Figure 37: Teachers by age

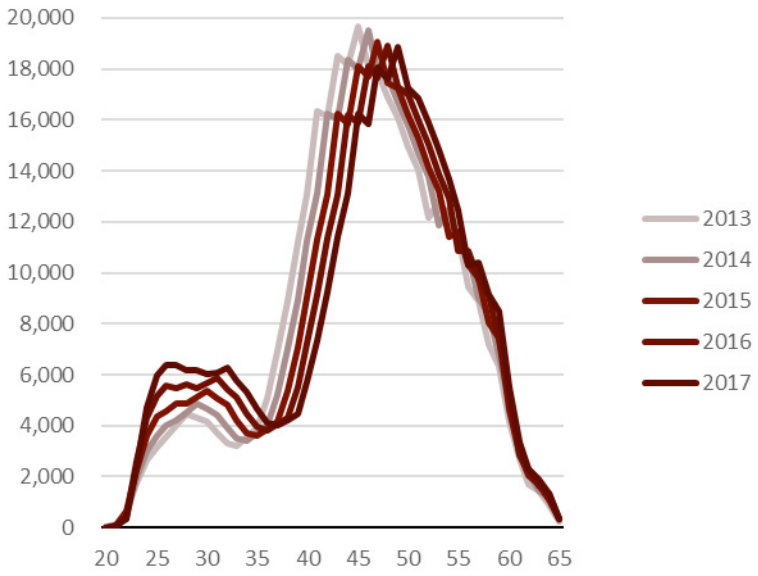
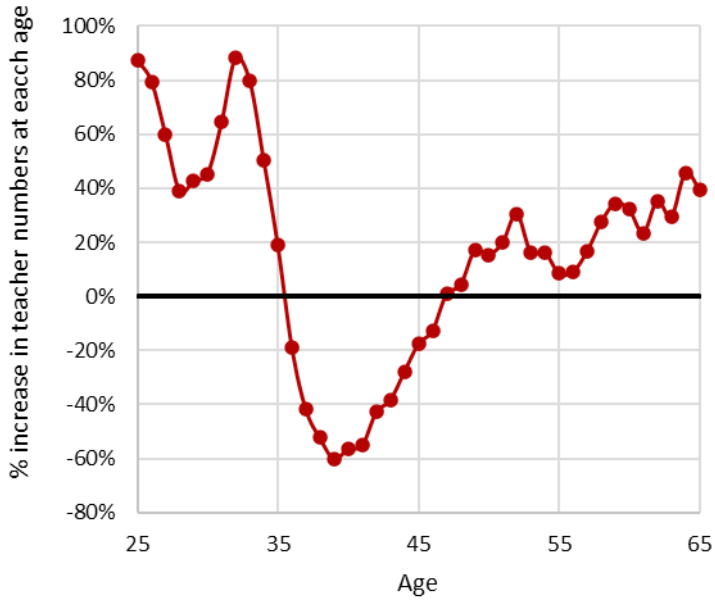


Table 29: Teacher numbers by age category, 2013 and 2017

Age group	Number		Percentage	
	2013	2017	2013	2017
20-34 years	42,616	68,100	12%	19%
35-49 years	206,940	154,883	56%	42%
50+ years	120,279	144,135	33%	39%
Total	**369,835**	**367,118**	**100%**	**100%**

Figure 38: Growth in numbers at each age level between 2013 and 2017



2.2 Teacher transitions in PERSAL between 2013 and 2017

Transitions are regarded as all those teachers who appeared in PERSAL one year who were not present in the previous year (teachers joining), or not present in the following year (teachers exiting).[28] Table 30 below shows the numbers of teachers who transitioned in the years 2013 and 2017, ignoring the intervening years. Altogether 114, 575 teachers present in the 2017 data were absent from the 2013 data, i.e. had joined the public teaching profession. The teachers constituted 31% of all teachers in 2013. Large numbers of joiners were found in Limpopo (almost 24,000, or 44% of teachers in that province), Gauteng (23,000, or 41% of teachers) and KwaZulu-Natal (21,000). Although the number of teachers in KwaZulu-Natal who joined PERSAL was large, the relative proportion of teachers in that province was lower, given the size of the province's teacher cohort. Joiner rates greater than KwaZulu-Natal's were found in the Northern Cape and the Western Cape (both 39%). In the case of Limpopo, statistics were only available for three of the four years under review; as 2013 data was unavailable, 2014 data was used.

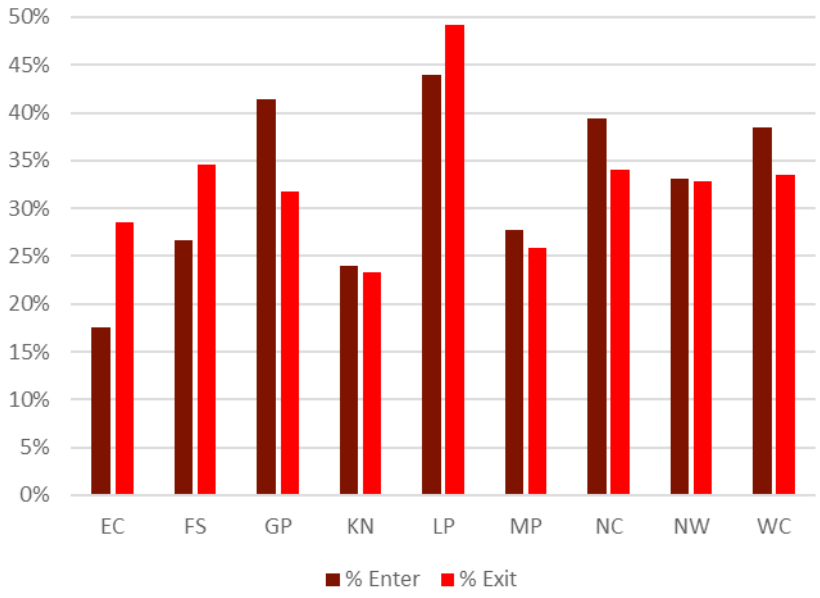
The proportion of teachers that left PERSAL between 2013 and 2017 – i.e. who were present in the 2013 PERSAL data but not in the 2017 data – is close to the proportion that joined between 2013 and 2017 (32% compared to 31%), suggesting that there was little change in the total number of teachers during the period under review. The largest exit rates were experienced in the same three provinces that exhibited the largest joining rates. The biggest gap between exit and entry was in the Eastern Cape, where teacher numbers dropped by more than 6,000 (or 11%). The Free State and Limpopo also showed a decline in teacher numbers. Population shifts between provinces and the closing of small schools in the Eastern Cape and Free State may have contributed to these declines in teacher employment.

28 It was mentioned earlier that 2013 PERSAL data for Limpopo was not available in the data set provided. Therefore the 2014 data for Limpopo was used for 2013. At national level, this results in a slight under-estimation of transitions (both entries and exits) between 2013 and 2014.

Table 30: Teachers transitioning between 2013 and 2017 by province

	2013	2017	Join	Exit	Gap	% Join	% Exit	% Gap
EC	58,530	52,083	10,281	16,728	-6,447	18%	29%	-11%
FS	21,288	19,590	5,669	7,367	-1,698	27%	35%	-8%
GP	55,141	60,400	22,801	17,542	5,259	41%	32%	10%
KZN	87,988	88,497	21,049	20,540	509	24%	23%	1%
LP	54,299	51,426	23,841	26,714	-2,873	44%	49%	-5%
MP	32,227	32,845	8,942	8,324	618	28%	26%	2%
NC	8,616	9,077	3,396	2,935	461	39%	34%	5%
NW	24, 570	24, 634	8,134	8,070	64	33%	33%	0%
WC	27,168	28,528	10,462	9,102	1,360	39%	34%	5%
	369,827	367,080	114, 575	117,322	-2,747	31%	32%	-1%

Figure 39: Entry and exit in percentages by province, 2013-2017



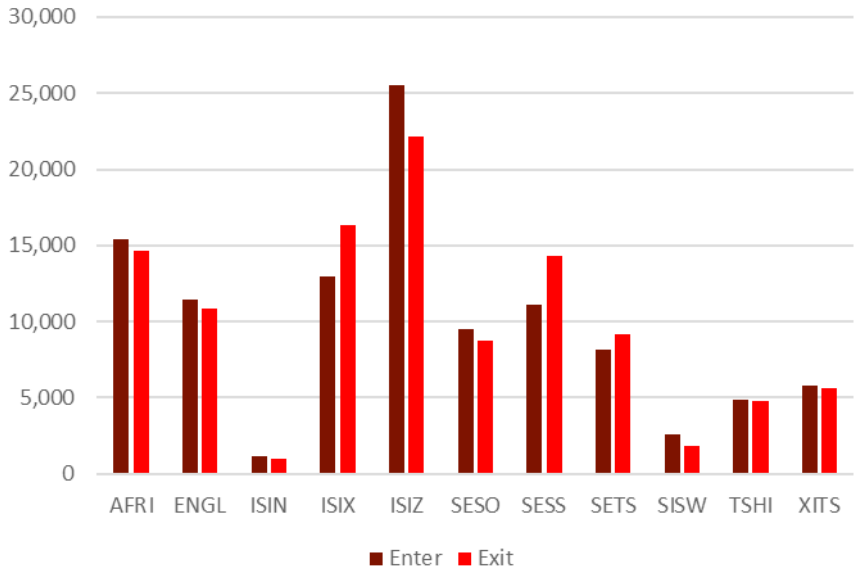
There are few differences in exit and joining by major school type – primary and secondary teachers were approximately equally likely to join and to exit, although the number of 63,000 primary school teachers who joined or exited is larger than the 45,000 secondary schools teachers who joined or exited (see Appendix Table 2). The gender composition of teachers became slightly more skewed towards women during the period 2013 to 2017, with 1,800 more women joining PERSAL than exiting, and 4,000 more men exiting than joining (see Table 31). However, these changes were small in percentage terms. There was also little change in the population group composition of teachers between 2013 and 2017: the decline of 2,400 in employment of black African teachers (Table 31) is quite small in percentage terms. Table 31 also shows slightly more mobility both into and out of PERSAL by white and coloured teachers.

Table 31 and Figure 39 also show exit and entry of teachers by home language. Exits are largely balanced by similar numbers joining within language groups, however a few language groups experienced a nett loss in employment in PERSAL: isiXhosa-speaking teachers decreased by 3,400 (or 6% of their initial numbers), Sesotho-speaking teachers decreased by 3,200 (an 11% decline relative to their initial numbers), and Setswana-speaking teachers decreased by 1,000 (4%of their initial employment).

Table 31: Teachers transitioning between 2013 and 2017 by gender, population group and home language

	2013	2017	Enter	Exit	Gap	% Enter	% Exit	% Gap
Female	253,060	254,869	77,843	76,034	1,809	31%	30%	1%
Male	116,767	112,211	36,732	41,288	-4,556	31%	35%	-4%
Black	300,042	297,638	88,999	91,403	-2,404	30%	30%	-1%
Coloured	26,732	26,742	9,467	9,457	10	35%	35%	0%
Indian	10,550	10,264	2,975	3,261	-286	28%	31%	-3%
White	32,503	32,436	13,134	13,201	-67	40%	41%	0%
Afrikaans	39,533	40,279	15,377	14,631	746	39%	37%	2%
English	33,232	33,810	11,413	10,835	578	34%	33%	2%
IsiNdebele	3,373	3,545	1,158	986	172	34%	29%	5%
IsiXhosa	61,306	57,898	12,924	16,332	-3,408	21%	27%	-6%
IsiZulu	92,485	95,842	25,539	22,182	3,357	28%	24%	4%
Sepedi	26,059	26,777	9,473	8,755	718	36%	34%	3%
Sesotho	30,458	27,250	11,079	14,287	-3,208	36%	47%	-11%
Setswana	27,622	26,622	8,160	9,160	-1,000	30%	33%	-4%
SiSwati	8,726	9,447	2,561	1,840	721	29%	21%	8%
Tshivenda	11,033	11,119	4,837	4,751	86	44%	43%	1%
Xitsonga	15,187	15,285	5,765	5,667	98	38%	37%	1%
Other	14,665	14,826	4,626	4,465	161	32%	30%	1%
Unknown	6,148	4,380	1,663	3,431	-1,768	27%	56%	-29%
Total	**369,827**	**367,080**	**114,575**	**117,322**	**-2,747**	**31%**	**32%**	**-1%**

Figure 40: Teachers transitioning in numbers by language



2.3 Teachers joining PERSAL between 2013 and 2017

Data available for this research study did not allow full backward tracking of teachers observed in PERSAL. If data were available for every possible year, it would in principle be possible to track all teachers joining PERSAL between 2013 and 2017 back to the universities at which they studied in HEMIS and also back to when they completed matric.

Table 32 shows estimated teacher employment for public and independent schools combined for the period 2004 to 2014, drawn from Van Broekhuizen (2015). Assuming conservatively an annual gross attrition rate of 4%, the annual number of new joiners can be estimated and compared to the number of ITE graduates in the previous year. Over the 11-year period, just over 100,000 ITE graduates were produced, compared to an estimated 238,000 joiners over the period. This points to the existence of a 'reserve teacher stock', i.e. individuals who qualified as teachers but are not always employed as teachers. However, as Van Broekhuizen, (2015, p. 34) notes, this reserve stock, though useful to have, cannot be depended on when calculating future needs, as it is "ultimately finite unless it is being replenished at the same rate at which it is being depleted".

Table 32: Historical estimates of teachers employed, exiting and joining and ITE graduates

	Teachers employed	Teachers exiting	Teachers joining	ITE graduates in previous year
2004	362,042	14,504	13,948	8,074
2005	382,133	14,482	34,573	10,506
2006	386,595	15,270	20,122	7,626
2007	395,452	15,464	24,321	7,188
2008	400,953	15,818	21,319	6,413
2009	411,164	16,038	26,249	6,159
2010	418,109	16,447	23,392	6,953
2011	420,608	16,724	19,223	8,284
2012	425,167	16,824	21,383	10,540
2013	425,023	17,007	16,863	13,153
2014	425,090	17,001	17,068	15,655
Total	**4,452,336**	**175,594**	**238,086**	**100,551**

Note: Teachers exiting assumed to be 4% gross per year.

Source: Van Broekhuizen (2015, p. 33)

Tracing teachers in PERSAL back through the university and schooling sectors revealed some interesting patterns, shown in Table 33, Table 34 and Figure 40.Firstly, it is evident that most teachers who matriculated in 2008 and later and who were traced through HEMIS and into PERSAL in 2017 were relatively young, as one would have expected. Secondly, there is a group of teachers that joined PERSAL in the period under consideration that were observed in HEMIS data (i.e. from 2010 onwards), but not in the matric data available for this research. This group of teachers must have matriculated in 2007 or earlier, or outside the public school system. Thirdly, the oldest group, with the peak (mode) towards the right, were only observed in PERSAL and not in the HEMIS or the matric data. That is probably because of their ages, as most of them were in their forties or fifties. It is possible that many had been teachers previously, but could not be tracked in the PERSAL data from 2013 or later. Surprisingly, 589 teachers in this group were younger than 30 years of age when they joined PERSAL and would thus have been expected to have been observed in HEMIS since 2010, unless they completed their studies elsewhere (for example, they were foreign teachers or they had studied abroad). This anomaly may also be the result of errors in reported teacher ages. Lastly, it is interesting to note that almost 172,000 teachers who had joined PERSAL before 2017 had not been observed as matriculants in 2008 or in subsequent matric examination data, but were observed in HEMIS (column 6 of Table 34). A few of these teachers may have written the Independent Education Board (independent school) matric examinations and not the National Senor Certificate (NSC) (public school) matric examinations. It is interesting that 13% of the teachers shown in this column have not completed a university qualification; some may be studying to improve their qualifications while in-service.

Table 33: Teachers in PERSAL in 2017 according to whether they were new in PERSAL or had remained from 2016, and how they were traced in matric and HEMIS data

Age	Joined in 2017			Remained from 2016			Total 2017
	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	
19	1	0	0	0	0	0	1
20	3	3	1	0	0	0	7
21	57	3	8	8	1	0	77
22	302	21	22	36	9	3	393
23	1,905	194	47	381	31	23	2,581
24	2,187	150	107	2,384	124	54	5,006
25	1,891	118	102	3,944	202	70	6,327
26	1,462	115	74	4,678	386	84	6,799
27	914	320	85	3,703	1,713	116	6,851
28	309	705	71	1,062	4,314	133	6,594
29	105	802	72	391	4,988	237	6,595
30	40	774	106	173	4,684	638	6,415
31	25	640	92	54	4,619	1,066	6,496
32	8	616	113	31	4,583	1,339	6,690
33	4	535	117	19	4,061	1,457	6,193
34	5	428	110	11	3,628	1,472	5,654
35	0	379	102	5	3,112	1,378	4,976
36	1	317	88	8	2,690	1,285	4,389
37	0	334	101	5	2,519	1,323	4,282
38	1	294	88	0	2,675	1,424	4,482
39	0	270	90	1	2,797	1,603	4,761
40	0	291	121	2	3,466	2,162	6,042
41	0	277	143	2	4,299	3,041	7,762
42	0	265	172	0	5,496	3,839	9,772
43	1	255	203	0	6,577	5,009	12,045
44	0	247	223	0	7,380	6,022	13,872
45	0	265	256	0	8,940	7,717	17,178
46	0	191	280	0	8,325	8,003	16,799
47	0	212	322	0	9,206	9,378	19,118
48	0	185	298	0	8,756	9,477	18,716

Age	Joined in 2017			Remained from 2016			Total 2017
	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	
49	0	154	315	1	9,031	10,448	19,949
50	0	134	368	0	7,867	10,014	18,383
51	0	117	299	0	7,415	10,164	17,995
52	0	116	314	0	6,556	9,982	16,968
53	0	67	289	0	6,062	9,521	15,939
54	0	66	232	0	5,327	9,092	14,717
55	0	50	194	0	4,664	8,534	13,442
56	0	27	179	0	3,654	7,358	11,218
57	0	28	164	0	3,402	7,676	11,270
58	0	15	139	0	2,647	7,164	9,965
59	0	25	132	0	2,289	6,828	9,274
60	0	14	105	0	1,329	4,684	6,132
61	0	4	92	0	777	3,043	3,916
62	0	3	72	0	457	2,210	2,742
63	0	1	57	0	305	1,878	2,241
64	0	1	47	0	204	1,366	1,618
65	0	1	10	0	40	372	423
Above 65	0	0	12	0	6	33	51
Total	**9,221**	**10,029**	**6,634**	**16,899**	**171,613**	**178,720**	**393,116**
% of joiners	36%	39%	26%				
% of 2017, total	2.3%	2.6%	1.7%	4.3%	43.7%	45.5%	100.0%

Note: Teachers observed in PERSAL in 2017 could have joined PERSAL in 2017 or earlier (i.e. remained in PERSAL from 2016). Those observed in the matric datasets (which go back to 2008) and in HEMIS were placed in the first category, "Matric 2008 or later". Those observed in the HEMIS data (available from 2010) but not in matric were assumed to have completed matric before 2008, categorised in the table as "Matric before 2008". Those not observed in HEMIS and not in the matric datasets were assumed to have studied at university before 2010, and were thus categorised as "Not in HEMIS". Some classifications may be incorrect, because of data errors (e.g. there is one 19-year-old teacher), teachers who were attended private schools and did not write public school matric examinations, or teachers who obtained their qualifications in other countries. These small errors would not change the picture much.

Figure 41: Teachers joining PERSAL in 2017 by how they were traced in matric and HEMIS data

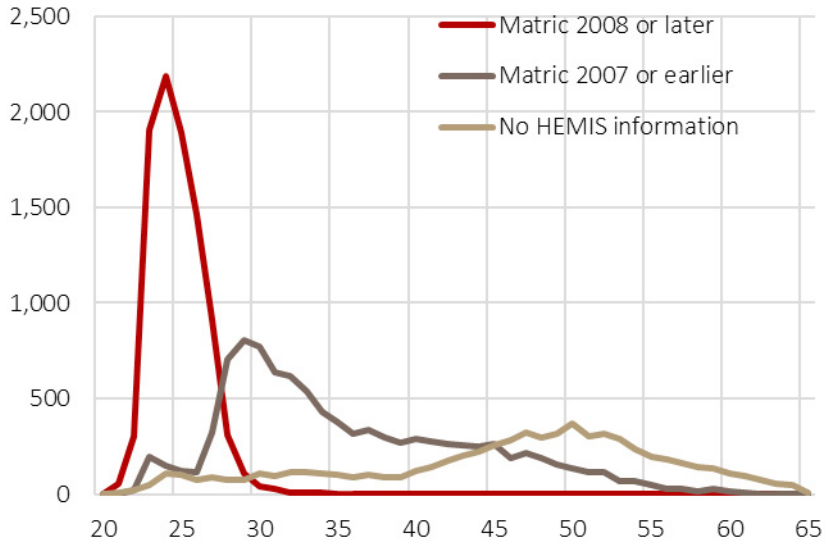


Table 34: Teachers in PERSAL in 2017 in terms of whether they were new in PERSAL or had remained from 2016, how they were traced in matric and HEMIS data, and by gender, population group and province

	Joined in 2017			Remained from 2016			Total 2017
	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	
Female	64%	77%	61%	65%	71%	68%	69%
Male	36%	23%	39%	35%	29%	32%	31%
Black	73%	79%	64%	70%	88%	74%	80%
Coloured	10%	7%	13%	11%	6%	9%	7%
Indian	3%	3%	3%	3%	2%	4%	3%
White	14%	10%	20%	16%	4%	14%	10%
EC	9%	10%	12%	7%	12%	17%	14%
FS	6%	4%	5%	9%	5%	6%	6%
GP	22%	21%	22%	23%	15%	18%	17%
KZN	20%	24%	12%	23%	26%	22%	23%
LP	10%	14%	14%	6%	16%	12%	14%
MP	8%	8%	6%	9%	10%	7%	9%
NC	3%	2%	5%	3%	2%	3%	2%
NW	9%	8%	9%	8%	7%	6%	7%

	Joined in 2017			Remained from 2016			Total 2017
	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	Matric 2008 or later	Matric 2007 or earlier	No HEMIS information	
WC	11%	9%	15%	12%	6%	10%	8%
No Degree	3%	8%	-	2%	13%	-	-
Degree	97%	92%	-	98%	87%	-	-
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

2.4 New teachers in 2017 by qualification

Focusing only on teachers who joined PERSAL in 2017 with a completed teaching qualification, it is possible to track those who were observed in HEMIS since 2010 back to the HEMIS data to obtain information regarding their university studies. These results are shown in Table 35 and Figure 41. The first noteworthy result is that almost two-thirds of ITE students had initially enrolled full-time[29]. North West University and the University of KwaZulu-Natal enrolled the largest numbers of full-time ITE students: 1 236 and 1 014 students respectively. These numbers were dwarfed, however, by part-time students at Unisa (3 688) and at North- West University (1 759). Together, North West University and Unisa enrolled 38% of all students who could be tracked from HEMIS to PERSAL in 2017. The results in the table also point to interesting findings on the qualifications for which ITE students were enrolled: well over half (63%) of full-time students who joined PERSAL in 2017 had enrolled for a BEd, a four-year degree programme if studied full-time. Among part-time students, only 34% had enrolled for a BEd. If one includes students who studied post-graduate diplomas or post-graduate certificates (especially the common PGCE), altogether 77% of all students who joined PERSAL in 2017 with completed qualifications had completed at least a bachelor's degree.

Table 35: Highest degree/diploma completed by university among full-time and part-time students since 2010 who joined PERSAL in 2017

	BEd	PG-D	PG-C	UG-D	UG-C	Other	Total	% of FT or PT	% of Total
Full-time (FT)									
CPUT	558	0	0	9	77	0	644	5.6%	3.7%
CUT	300	5	141	11	32	0	489	4.2%	2.8%
DUT	0	1	0	192	114	0	307	2.7%	1.7%
UFH	271	16	101	13	0	0	401	3.5%	2.3%
UFS	301	35	165	132	18	3	654	5.7%	3.7%
UJ	464	24	36	37	19	91	671	5.8%	3.8%
UKZN	619	13	316	50	15	1	1,014	8.8%	5.8%

29 Some students initially commence full-time studies but later switch to completing their studies part-time. Students are classified here according to their mode of study when they were first observed in the HEMIS data.

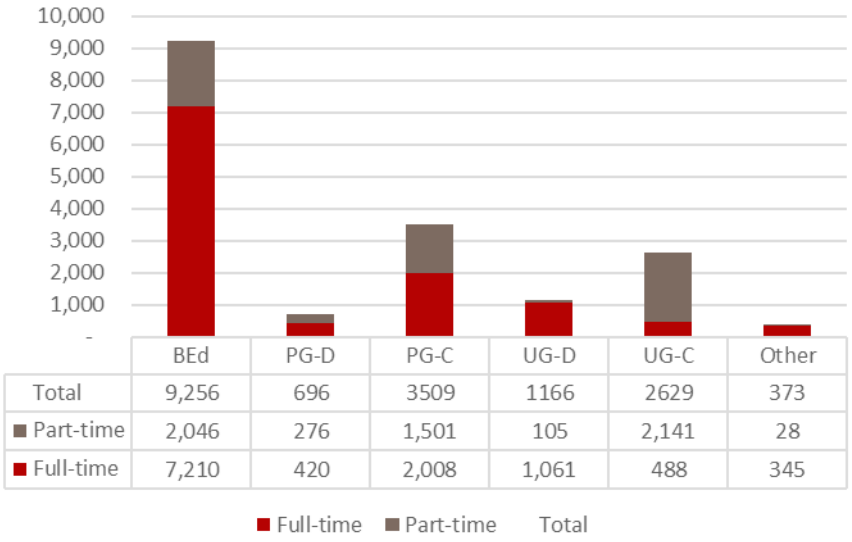
	BEd	PG-D	PG-C	UG-D	UG-C	Other	Total	% of FT or PT	% of Total
Full-time (FT)									
UL	484	12	64	115	42	157	874	7.6%	5.0%
NMMU	187	9	40	12	12	0	260	2.3%	1.5%
NWU	647	124	199	238	28	0	1,236	10.7%	7.0%
UP	463	67	51	37	0	42	660	5.7%	3.7%
Unisa	181	18	112	10	12	0	333	2.9%	1.9%
US	127	33	48	16	3	43	270	2.3%	1.5%
TUT	447	0	0	18	53	0	518	4.5%	2.9%
UNIVEN	423	17	165	46	5	5	661	5.7%	3.7%
WSU	566	2	145	20	50	0	783	6.8%	4.4%
UWC	235	16	135	28	1	3	418	3.6%	2.4%
Wits	268	18	64	37	2	0	389	3.4%	2.2%
UZ	669	10	226	40	5	0	950	8.2%	5.4%
Total full-time	**7,210**	**420**	**2,008**	**1,061**	**488**	**345**	**11,532**	**100%**	**65.4%**
% of full-time	63%	4%	17%	9%	4%	3%	100%		
Part-time (PT)									
NWU	188	39	31	0	1487	14	1,759	28.9%	10.0%
Unisa	1848	151	1397	51	239	2	3,688	60.5%	20.9%
Other	10	86	73	54	415	12	650	10.7%	3.7%
Total part-time	**2,046**	**276**	**1,501**	**105**	**2,141**	**28**	**6,097**	**100%**	**34.6%**
% of part-time	34%	5%	25%	2%	35%	0%	100%		
Full-time + part-time	9,256	696	3509	1,166	2629	373	17,629		100%
% of full-time + part-time	53%	4%	20%	7%	15%	2%	100%		

Note: PG-D: Post-graduate Diploma; PG-C: Post-graduate Certificate; UG-D: Undergraduate Diploma;

UC-C: Undergraduate Certificate.

CPUT: Cape University of Technology; CUT: Central University of Technology; DUT: Durban University of Technology; UFH: University of Fort Hare; UFS: University of the Free State; UJ: University of Johannesburg; UKZN: University of KwaZulu-Natal; UL: University of Limpopo; NMMU: Nelson Mandela Metropolitan University; NWU: North West University; UP: University of Pretoria; Unisa: University of South Africa; US: University of Stellenbosch; TUT: Tshwane University of Technology; UNIVEN: University of Venda; WSU: Walter Sisulu University; UWC: University of the Western Cape; Wits: University of the Witwatersrand; UZ: University of Zululand

Figure 42: Qualifications enrolled for by full-time and part-time students who joined PERSAL in 2017 with completed qualifications



	BEd	PG-D	PG-C	UG-D	UG-C	Other
Total	9,256	696	3509	1166	2629	373
Part-time	2,046	276	1,501	105	2,141	28
Full-time	7,210	420	2,008	1,061	488	345

Table 36 shows that while around two-thirds of black African and white students and three-quarters of coloured students were enrolled full-time, the number of Indian students enrolled in full-time and in part-time ITE programmes was roughly equal. Sesotho and isiZulu-speaking students had the highest proportional enrolments in part-time programmes, at 52% and 41% respectively. The table further shows that isiZulu-speaking students were under-represented in full-time post-graduate diploma programmes, accounting for 29% of the total teachers shown in this table but making up only 10% of teachers who enrolled in these programmes. Conversely, isiZulu-speaking students are overrepresented in part-time BEd degree enrolments.

Table 36: Degree/diploma enrolled for by home language among full-time and part-time students who joined PERSAL in 2017

	Full-time							Part-time							Total FT + PT	
	BEd	PG-D	PG-C	UG-D	UG-C	Other	Total	BEd	PG-D	PG-C	UG-D	UG-C	Other	Total	Total	% of total
Black	5,261	228	1590	939	432	278	8,728	1346	160	1152	86	1973	17	4734	13,462	76%
Coloured	721	28	176	36	45	22	1,028	172	22	47	9	103	5	358	1,386	8%
Indian	188	14	44	19	2	3	270	137	21	75	3	12	1	249	519	3%
White	1,038	150	198	67	9	42	1,504	389	72	221	6	53	5	746	2,250	13%
Afrikaans	1,242	142	241	65	38	43	1,771	387	52	156	8	117	9	729	2,500	14%
English	744	60	198	72	27	32	1,133	342	69	196	12	110	4	733	1,866	11%
IsiNdebele	99	0	4	8	2	5	118	5	4	13	0	47	1	70	188	1%
IsiXhosa	1,131	37	317	82	102	12	1,681	132	20	97	11	218	4	482	2,163	12%
IsiZulu	1,828	44	617	321	151	24	2,985	927	48	506	37	580	4	2,102	5,087	29%
Sepedi	742	34	262	137	63	117	1,355	28	13	79	5	139	0	264	1,619	9%
Sesotho	186	14	58	40	15	43	356	70	30	208	9	72	3	392	748	4%
Setswana	285	31	74	208	43	13	654	75	11	61	12	246	0	405	1,059	6%
SiSwati	327	1	16	13	7	4	368	15	1	19	1	117	0	153	521	3%
Tshivenda	210	15	119	35	8	8	395	8	6	47	1	54	0	116	511	3%
Xitsonga	300	11	67	34	19	41	472	18	6	75	4	140	2	245	717	4%
Other	55	6	12	21	7	1	102	35	13	42	5	298	1	394	496	3%
Unknown	61	25	23	25	6	2	142	4	3	2	0	3	0	12	154	1%
Total	**7,210**	**420**	**2,008**	**1,061**	**488**	**345**	**11,532**	**2,046**	**276**	**1,501**	**105**	**2,141**	**28**	**6,097**	**17,629**	**100%**
% of FT or PT	**63%**	**4%**	**17%**	**9%**	**4%**	**3%**	**100%**	**34%**	**5%**	**25%**	**2%**	**35%**	**0%**	**100%**		
% of total	**41%**	**2%**	**11%**	**6%**	**3%**	**2%**	**65%**	**12%**	**2%**	**8%**	**1%**	**12%**	**0%**	**35%**	**100%**	

Comparing DHET's enrolment plans with realised ITE graduates provides a useful indication of whether or not the country's higher education sector has produced the requisite number of ITE graduates in recent years. To this end, Table 37 shows planned enrolments outlined in DHET's 2011 to 2019 enrolment plan and the estimated number of graduates according to this enrolment plan (calculated by Simkins, 2015, p. 12, Table 8) for the period 2012 to 2019. Comparing the estimated number of graduates to the realised number in 2016 in this report (reported in the previous table) reveals that the realised number of graduates for that year was relatively close to Simkins' (2015) estimated number, at 17,629 and 19,403, respectively. Similarly, the 17,545 'teaching graduates' which the enrolment plan made provision for was relatively close to the 19,214 realised graduates in 2013.

Table 37: DHET enrolment plan for universities and Simkins' estimates of possible graduation numbers for BEd and PGCE

	BEd			PGCE			Total estimated graduates
	University planned enrolments	Estimated graduates	Rate	University planned enrolments	Estimated graduates	Rate	
2012	81,905	8,003	9.8%	12,332	5,705	46.3%	13,708
2013	92,759	8,732	9.4%	12,332	5,871	47.6%	14,604
2014	85,047	11,053	13.0%	14,050	6,492	49.4%	17,545
2015	91,050	11,374	12.5%	15,236	6,941	45.4%	18,315
2016	98,427	11,932	12.1%	16,608	7,471	45.0%	19,403
2017	105,010	12,531	11.9%	18,433	8,214	44.6%	20,745
2018	109,609	13,204	12.0%	19,989	8,827	44.2%	22,031
2019	113,890	13,909	12.2%	21,881	9,602	43.9%	23,511

Sources: Simkins 2015, p. 12. Table 8; DHET, 2016, p. 28-29)

3 Tracking students from matric into university

3.1 The pipeline from school to a teaching degree (BEd)

Using the matric data (2008-2017) matched to HEMIS data (for 2010-2017) makes it possible to observe which students, and how many, entered university for degree studies. Since not all matriculants enter university immediately, allowing for the possibility that individuals might only enter university in the second or third year after matric means that the 2013 matric is the most recent one that can be tracked in HEMIS. Table 38 shows the home language and province of the 2013 matric cohort; this cohort was chosen in order to look at recent trends, but to still allow three years for entry into HEMIS. Of the 565,000 matriculants of 2013, 25.2% enrolled in undergraduate degrees at university in the three years immediately following matriculation, with 10.5% of degree students enrolling in BEd programmes. Matriculants with the home language English or Afrikaans (41.7% and 34.6% of matriculants, respectively) were far more likely than others to enrol for a degree, while Afrikaans and isiZulu home language students were particularly inclined to enrol for BEd degrees. More than a third of BEd students from this matric cohort were from KwaZulu-Natal.

Table 38: Home language and province of 2013 matriculants enrolling for a BEd or alternative degree at universities in 2014-2016

	Any degree	BEd	Number of matriculants	BEd as percentage of all degrees
Home language				
Afrikaans	29.6%	5.0%	50,068	14.4%
English	38.9%	2.8%	106,035	6.7%
IsiNdebele	14.5%	3.0%	4,286	17.1%
IsiXhosa	15.9%	1.8%	80,653	10.0%
IsiZulu	17.4%	3.3%	137,523	15.9%
Sepedi	16.4%	1.6%	64,818	9.0%
Sesotho	15.6%	3.0%	28,263	16.0%
Setswana	17.1%	1.9%	40,501	10.1%
SiSwati	19.7%	3.5%	16,549	15.1%
Tshivenda	28.0%	1.6%	14,784	5.3%
Xitsonga	19.0%	1.7%	21,791	8.2%
Unknown	50.0%	0	8	0.0%
Province				
EC	19.0%	1.9%	73,652	9.3%
FS	23.9%	3.9%	26,594	13.9%
GA	26.7%	2.7%	95,020	9.3%
KZN	23.3%	3.6%	144,551	13.3%
LP	20.1%	1.9%	90,382	8.6%
MP	17.9%	2.6%	48,282	12.7%
NC	15.4%	1.8%	10,125	10.4%
NW	22.9%	2.6%	30,503	10.2%
WC	26.4%	2.7%	46,170	9.3%
Total	**22.5%**	**2.7%**	**565,279**	**10.8%**

3.2 Matric results of prospective teachers

Teaching is not universally regarded as an attractive profession (Gustafsson & Maponya, 2020). Salaries are often perceived to be relatively low and promotion possibilities are more constrained in teaching than in many other jobs. In developing countries, teacher salaries are often initially far above average, as teachers tend to be better educated than most people in the population. As economies expand and more people with a tertiary education are required across society, teachers may lose their initial advantage (Van der Berg & Burger (2010) and Crouch (2001) discuss this further). In addition, Armstrong (2014) showed that the teaching profession is relatively poorly remunerated for persons at the top end of the

skills distribution, which may result in teaching failing to attract many good candidates. However, in South Africa teacher salaries rose sharply in 2008 and have continued to rise since then. Furthermore, some people, especially secondary earners in a household, find aspects of teachers' working conditions attractive, such as extended school holidays. It remains unclear to what extent matriculants with excellent matric results are attracted to the teaching profession. One way of evaluating this is to compare the matric results of BEd students and students who enrol for other degrees.

Table 39 shows the matric performance of the 2013 matric cohort which enrolled for BEd and non-BEd degrees respectively in the following three years, using two measures: the average of their matric results across all subjects, and the proportion which took Mathematics as an elective and then obtained a mark of 50% or higher for Mathematics. For non-BEd students, the average mark across matric subjects was 68%, while BEd students obtained only 63%, *viz.* a five percentage point difference. For the largest population group, black Africans, the difference between the two groups of students was only three percentage points. Wits University and the University of Pretoria had the largest differences between the two groups, although the average matric result of students who enrolled for a BEd at those two universities was relatively high.

Differences between BEd and non-BEd students were especially large in the case of the second measure of matric performance shown in the table, i.e. the proportion of students who elected to do the Mathematics matric examination rather than Mathematical Literacy and who obtained at least 50% for that subject. This proportion was 54% for students studying for other degrees, but only 20% for students enrolling for a BEd. This difference was especially stark for the Indian and white population groups, and even more pronounced amongst Afrikaans and English home language students. Wits and Pretoria University were again the universities where the proportions of BEd students who had taken Mathematics and obtained at least 50% for that subject were largest (31 and 41%, respectively).

In summary, students enrolled for BEd studies had poorer matric results than students enrolled for other degrees, and the difference was especially striking in terms of the proportion who obtained at least 50% in Mathematics in matric.

Table 39: Matric performance of members of the 2013 matric cohort enrolled for BEd or other degrees in 2014-2016

	Other degrees	BEd	% BEd	Total	Average matric mark			Scored 50% or higher for Maths		
					Other degrees	BEd	Difference	Other degrees	BEd	Difference
Black	41,722	10,338	20%	52,060	65%	62%	-3%	46%	18%	-28%
Coloured	5,168	1,083	17%	6,251	67%	63%	-4%	49%	12%	-37%
Indian	5,897	794	12%	6,691	73%	66%	-8%	77%	25%	-52%
White	12,651	2,520	17%	15,171	73%	68%	-5%	74%	28%	-46%
Afrikaans	9,645	2,314	19%	11,959	72%	67%	-5%	68%	24%	-44%
English	15,337	2,122	12%	17,459	71%	65%	-6%	67%	21%	-46%
IsiNdebele	420	149	26%	569	66%	63%	-3%	52%	26%	-26%
IsiXhosa	7,351	1,622	18%	8,973	64%	60%	-4%	44%	18%	-26%
IsiZulu	13,543	4,672	26%	18,215	66%	63%	-3%	42%	16%	-26%
Sepedi	5,253	1,259	19%	6,512	65%	62%	-3%	49%	20%	-28%
Sesotho	2,406	521	18%	2,927	67%	62%	-5%	58%	26%	-32%
Setswana	4,262	675	14%	4,937	64%	62%	-2%	42%	17%	-25%
SiSwati	1,247	562	31%	1,809	66%	63%	-3%	49%	26%	-24%
Tshivenda	2,914	246	8%	3,160	66%	62%	-3%	55%	26%	-29%
Xitsonga	1,986	389	16%	2,375	66%	62%	-4%	50%	17%	-33%
Other	1,119	204	15%	1,323	67%	65%	-1%	52%	20%	-32%
Unknown	128	12	9%	140	68%	63%	-5%	53%	17%	-36%
CPUT	740	666	47%	1,406	62%	65%	3%	39%	20%	-19%
CUT	291	627	68%	918	64%	60%	-5%	53%	18%	-35%
DUT	828	118	12%	946	66%	66%	0%	49%	53%	4%
UFH	1,264	312	20%	1,576	61%	61%	0%	37%	23%	-14%
UFS	4,035	548	12%	4,583	65%	66%	1%	45%	22%	-23%
UJ	5,397	670	11%	6,067	67%	66%	-1%	57%	22%	-34%
UKZN	8,348	1,131	12%	9,479	71%	69%	-3%	60%	19%	-41%
UL	2,943	503	15%	3,446	66%	63%	-4%	60%	35%	-25%
NMMU	2,388	283	11%	2,671	67%	67%	0%	49%	23%	-26%
NWU	6,414	1,207	16%	7,621	66%	64%	-2%	43%	17%	-26%
UP	5,679	848	13%	6,527	74%	66%	-7%	84%	31%	-52%
Unisa	6,346	3,503	36%	9,849	59%	61%	2%	18%	10%	-8%
US	3,635	214	6%	3,849	75%	71%	-4%	83%	45%	-38%

	Other degrees	BEd	% BEd	Total	Average matric mark			Scored 50% or higher for Maths		
					Other degrees	BEd	Difference	Other degrees	BEd	Difference
TUT	920	705	43%	1,625	63%	61%	-2%	36%	19%	-18%
UNIVEN	2,361	470	17%	2,831	62%	63%	1%	34%	19%	-15%
WSU	1,115	785	41%	1,900	62%	58%	-4%	45%	16%	-28%
UWC	3,343	246	7%	3,589	65%	62%	-2%	43%	13%	-30%
WITS	3,889	573	13%	4,462	76%	68%	-8%	87%	41%	-46%
UZ	2,165	1,133	34%	3,298	65%	64%	0%	30%	20%	-10%
Total	**65,438**	**14,735**	**18%**	**80,173**	**68%**	**63%**	**4%**	**54%**	**20%**	**34%**

4 Tracking education students from school and through university and into PERSAL[30]

4.1 On tracking students

Having tracked students from school to university in the previous chapter, it is now pertinent to investigate the flow of matriculants to university and then the flow of these students into PERSAL. In order to understand the supply of teachers, it is important to know how many students receive qualifications that would allow them to become teachers. However, once students qualify to become teachers, it does not automatically follow that they enter PERSAL and become public service teachers. Graduates have a number of choices at this point:

- Some may spend more time at university, enrolling for post-graduate studies.
- Others may take a gap year, perhaps teaching overseas or travelling.
- Some may start teaching immediately, but not as publicly remunerated teachers in public schools. They may elect to teach in private schools, or to fill SGB positions in public schools. Such positions are not funded by government, nor captured in PERSAL.
- Many graduates end up in jobs other than teaching. Some part-time education students may have started an alternative form of employment while studying, and may decide, after completion of their teaching qualification, to stay in their current position rather than entering teaching. (A teaching degree has value in securing other employment positions.)

This section discusses the flow of students captured in matriculation examinations data since 2008 through university and into PERSAL in terms of four categories: those who initially enrol for BEd studies, either full-time or part-time, and those who enrol for the PGCE (typically after completing a general non-teaching degree), again either full-time or part-time.

30 Because of small numbers for some cells when decomposing these numbers, calculations were really done for both the 2010 and the 2011 cohorts. That means that some students could not be followed into Year 8 for the 2011 cohort; estimates based on flows for the 2010 cohort were then applied.

3.2 Tracking full-time BEd students who enrolled in 2010 or 2011 into PERSAL

Table 40 and Figure 42 show that the majority (57%) of full-time BEd students completed their degree in the minimum time-frame of four years. However, this aggregate result masks important differences between population groups. Notably, there is roughly a 10 percentage point difference between the proportions of black African and coloured students (53% and 52%, respectively) who did so, and the proportions of white and Indian students who did so (65% and 69%, respectively). After five years, a total of 69% of full-time BEd students who had enrolled in 2010 or 2011 had graduated. In other words, an additional 12% of the initial group graduated in Year five. Adding a sixth year increases the proportion of graduates to 73%, that is, an additional 4% of the initial group obtain their degrees after six years of study. Beyond six years, only small additional numbers managed to graduate. After 8 years, 78% of students had graduated. Most of the other 22% had dropped out, although a few remained in the university system, often switching to part-time study programmes.

Table 40 and Figure 42 show the proportion of full-time BEd students who have both graduated and joined PERSAL. It is clear that many full-time BEd graduates do not enter the teaching profession immediately after graduating. For example, only 25% of the initial group of students who had enrolled in full-time BEd degrees had joined PERSAL in their fifth year. This is surprising, considering that 57% of these students completed their BEd in the previous year. This may be the result of the factors mentioned in the introduction to this section. Similarly, in the sixth year after enrolling, employment in PERSAL rose to 43% of those who had enrolled, still far below the 69% who had already graduated in their fifth year. Even by Year 8, only just over half (54%) of all students who had started BEd full-time studies had graduated and joined PERSAL. Again, there are racial differences: the gap between graduation and joining PERSAL is smallest for black African students, of whom 74% completed their degree in seven years; by Year 8, 65% had joined PERSAL, and for coloured students, of whom 68% had graduated and 59% had joined PERSAL by the following year. For white and Indian students, there is a far greater difference between completing their degree in year seven and joining PERSAL. This is consistent with the idea that many take up teaching posts at private schools or obtain SGB positions in public schools, although other factors mentioned earlier may also operate.

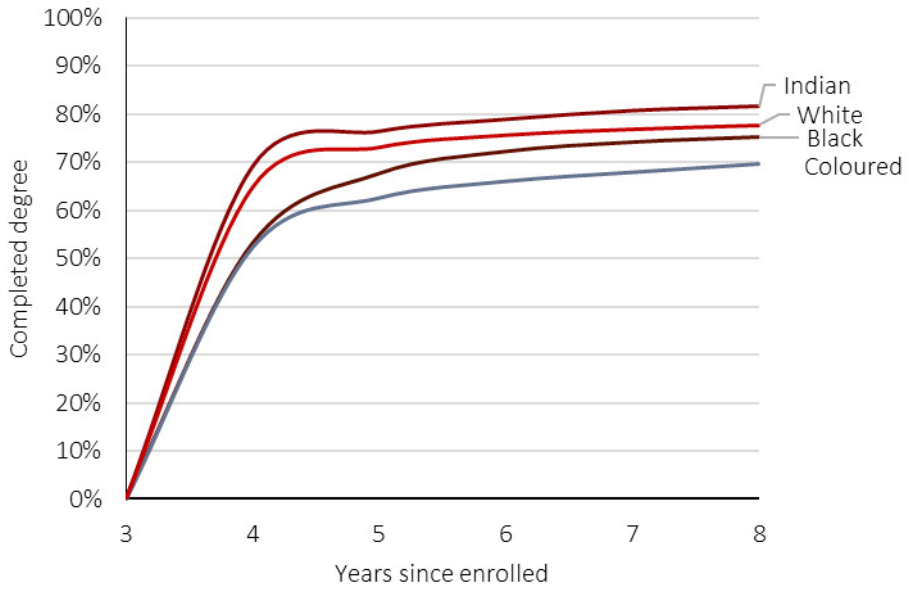
Table 40: Cumulative percentages of 2010 and 2011 first-time entering full-time BEd students who completed their degree and joined PERSAL by population group and year of study

	After 4 years	After 5 years	After 6 years	After 7 years	After 8 years	Cumulative number graduated
Completed degree						
Black	53%	68%	72%	74%	75%	3,199
Coloured	52%	63%	66%	68%	70%	581
Indian	69%	76%	79%	81%	82%	221
White	65%	73%	76%	77%	78%	1,862
Total	57%	69%	73%	75%	75%	5,862

	After 4 years	After 5 years	After 6 years	After 7 years	After 8 years	Cumulative number joined PERSAL
Joined PERSAL						
Black	1%	30%	52%	63%	65%	3,199
Coloured	0%	31%	48%	56%	59%	581
Indian	0%	20%	37%	49%	52%	221
White	0%	15%	26%	35%	39%	1,862
Total	**0%**	**25%**	**43%**	**53%**	**54%**	**5,862**

Note: Under the heading '5 years', for example, it is possible to read off in the top part of the table what cumulative percentage of students had completed their degree in their fifth year since enrolling in 2010 or 2011, and in the bottom part of the table it is possible to read off what percentage of students had completed their degree and had already joined PERSAL in the fifth year since enrolling. 'Joined PERSAL' here means EVER joined PERSAL at any time after graduating.

Figure 43: Top panel: Cumulative percentage of 2010-2011 first-time entering full-time BEd students who completed degree by population group and year. Lower panel: Cumulative percentage of 2010-2011 first-time entering full-time BEd students who completed their degree and joined PERSAL by population group and year



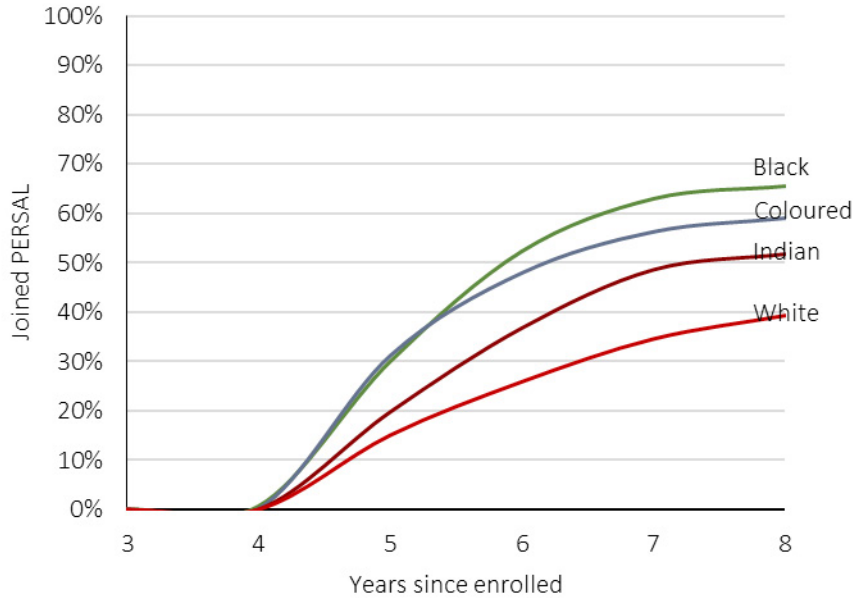


Table 41 summarises the outcomes by population group: it shows the number that enrolled in full-time BEd programmes, the number that did not graduate after 8 years, the number that graduated and did not join PERSAL, and the number that graduated and joined PERSAL. As can be seen, only around half (3,285 students, or 54%) of those who enrolled in full-time BEd programmes joined PERSAL within eight years of enrolling. Amongst white students in particular, a large proportion never joined PERSAL: despite a relatively high graduation rate – only half of white graduates joined PERSAL. These are important findings that must be kept in mind when planning ITE enrolments. Only 75% of students who enrol in full-time BEd programmes will graduate within eight years, and only 54% of those who enrol will graduate and join PERSAL. Thus, if we need 7,400 new full-time BEd graduates per year entering the public school system, the enrolment target needs to be 10,000.

Table 41: Outcomes of 2010-11 full-time BEd first-time enrolled students in Year 8[31] by population group

	Number enrolled	Failed to graduate	Graduated	Graduated did not join PERSAL	Graduated joined PERSAL	Failed to graduate	Graduated	Graduated did not join PERSAL	Graduated joined PERSAL
Black	3,199	795	2,403	309	2,094	25%	75%	10%	65%
Coloured	581	177	404	61	344	30%	70%	10%	59%
Indian	221	41	180	66	114	18%	82%	30%	52%
White	1,862	414	1,448	715	733	22%	78%	38%	39%
Total	**5,862**	**1,426**	**4,436**	**1,151**	**3,285**	**25%**	**75%**	**21%**	**54%**

31 Strictly speaking, students who completed their degree in Year 8 should not be included, as they would not yet have had the opportunity to join PERSAL in Year 8. However, their number is very small, and for simplicity they have been included with those who had "Graduated but did not join PERSAL".

Table 42: Proportion of full-time 2010-11 BEd first-time enrolled students who completed their degree and proportion who completed their degree and joined PERSAL, by university and by year since enrolment

	Cumulative percentage graduated						Cumulative percentage graduated and joined PERSAL						Number enrolled
	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	
CPUT	0%	71%	77%	79%	81%	81%	0%	0%	30%	46%	56%	60%	429
CUT	1%	31%	47%	54%	55%	59%	0%	2%	20%	40%	49%	52%	290
UFH	0%	66%	74%	76%	78%	79%	0%	0%	23%	45%	55%	57%	162
UFS	0%	51%	65%	68%	71%	71%	0%	0%	23%	36%	46%	52%	361
UJ	0%	45%	56%	61%	64%	65%	0%	1%	23%	41%	48%	49%	529
UKZN	0%	76%	84%	85%	86%	87%	0%	0%	36%	59%	71%	74%	465
UL	0%	76%	85%	87%	89%	89%	0%	0%	50%	73%	84%	86%	179
NMMU	0%	65%	75%	78%	80%	81%	0%	0%	24%	36%	44%	46%	219
NWU	0%	63%	70%	72%	73%	74%	0%	0%	21%	35%	43%	47%	753
UP	0%	55%	66%	70%	71%	72%	0%	0%	14%	25%	33%	37%	705
US	0%	65%	74%	78%	80%	83%	0%	0%	22%	34%	42%	47%	178
TUT	0%	52%	67%	72%	73%	74%	0%	2%	36%	55%	65%	67%	303
UNIVEN	0%	33%	64%	76%	79%	80%	0%	0%	25%	53%	70%	71%	115
WSU	0%	49%	68%	74%	77%	78%	0%	0%	16%	39%	54%	59%	345
UWC	0%	46%	59%	64%	65%	65%	0%	0%	27%	48%	55%	57%	146
WITS	0%	49%	67%	72%	74%	76%	0%	0%	22%	40%	49%	54%	296
UZ	0%	68%	81%	84%	85%	85%	0%	0%	34%	64%	77%	78%	391
Total	**0%**	**57%**	**69%**	**73%**	**75%**	**76%**	**0%**	**0%**	**20%**	**43%**	**53%**	**56%**	**5862**

Note: Under the heading 'Year 5', for example, it is possible to read off what percentage of students completed their degree in the fifth year since enrolling or earlier. In the right-hand part of the table, under the heading 'Year 5' it is possible to read off what percentage of students completed their degree before the fifth year since enrolling and had joined PERSAL by the fifth year or earlier.

3.3 Tracking 2010-11 part-time BEd students through university and into PERSAL

Looking at part-time BEd students in the same manner shows that flow-through rates among part-time students are much slower (Table 43). Fewer than half (47%) of Unisa BEd students had completed their degrees by the end of Year 8. This proportion was also low for North West University (64%). Table 43 also shows that many Unisa BEd graduates did not join PERSAL; while 39% had graduated by the end of Year 6, only 19% had joined PERSAL two years later, i.e. about half of Unisa graduates. A factor that may play a role here is that many part-time students may have obtained other (non-teaching) jobs while studying, and many be reluctant to give up such jobs to enter the teaching profession, despite the fact that this may have been their original intent.

Table 43: Proportion of part-time BEd students who completed their degree and proportion that completed and joined PERSAL by university

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Number
Cumulative percentage completed degree									
NWU	0%	0%	0%	53%	59%	63%	64%	64%	128
Unisa	0%	0%	0%	9%	27%	39%	44%	47%	1,116
Total	**0%**	**0%**	**0%**	**14%**	**30%**	**41%**	**46%**	**49%**	**1,244**
Cumulative percentage completed degree and joined PERSAL									
NWU	0%	0%	0%	0%	30%	40%	46%	53%	128
Unisa	0%	0%	0%	0%	2%	8%	16%	19%	1,116
Total	**0%**	**0%**	**0%**	**0%**	**4%**	**11%**	**19%**	**23%**	**1,244**

3.4 Tracking the 2014 full-time PGCE cohort through university and into PERSAL

Some students who initially sign up for non-teaching degrees subsequently enrol for a one-year PGCE after completing their first degrees to qualify to become teachers. Pass rates for this programme are high, as is shown in Appendix Table 4, with 90% of the 2014 cohort obtaining this qualification in their first year of study, although only 40% of these graduates immediately joined PERSAL. That is, of the students who enrolled in one-year full-time PGCE programmes, less than half (44%) went on to join the public schooling system in the year after graduating. In the following year, the proportion in PERSAL rose to 59%, and then to 63% in the fourth year after initial enrolment. The outcome in Year 4 is summarised by population group in Table 44. The largest population group differences are apparent for the proportion that graduated but did not join PERSAL: 63% of white students compared to only 16% of black African students graduated from their PGCE programmes but did not join PERSAL within four years. Because of smaller numbers, the ratios for the remaining two population groups may fluctuate more from year to year. The factors that may influence these differential outcomes are likely to be the same as those mentioned in Section 4.1

Table 44: PGCE Year 4 outcomes by population group for the 2014 cohort

	Number enrolled	Did not graduate	Graduated	Graduated did not join PERSAL	Graduated joined PERSAL	Did not gradate	Graduated	Graduated did not join PERSAL	Graduated joined PERSAL
Black	669	44	625	104	522	7%	93%	16%	78%
Coloured	91	3	88	22	66	3%	97%	24%	73%
Indian	30	2	27	14	14	8%	92%	46%	46%
White	245	12	233	155	78	5%	95%	63%	32%
Total	**1,034**	**60**	**974**	**295**	**679**	**6%**	**94%**	**32%**	**63%**

The outcomes by university shown in Table 45 demonstrate that there are a few universities where a very large proportion of graduates did not continue on to PERSAL: Stellenbosch University (63 %), Nelson Mandela Metropolitan University (47 %), Northwest University (42 %) and Walter Sisulu University (41 %). However, the small numbers who enrol for the PGCE may cause considerable fluctuation across cohorts. Students with Afrikaans (53%) or English (50%) as home language also have a greater propensity not to continue to PERSAL (Table 46).

Table 45: PGCE Year 4 outcomes by university for the 2014 cohort

	Number enrolled	Did not graduate	Graduated	Graduated but did not join PERSAL	Graduated and joined PERSAL	Did not graduate	Graduated	Graduated but did not join PERSAL	Graduated and joined PERSAL
CUT	100	14	86	16	71	14%	86%	16%	71%
UFH	40	3	37	10	28	8%	93%	24%	69%
UJ	29	3	26	8	18	9%	91%	28%	63%
UKZN	231	7	224	44	180	3%	97%	19%	78%
UL	29	3	25	1	25	11%	89%	2%	88%
NMMU	36	2	34	17	17	6%	94%	47%	47%
NWU	174	13	161	73	88	7%	93%	42%	51%
US	115	3	112	72	40	3%	97%	63%	34%
UNIVEN	15	0	15	1	13	0%	100%	10%	90%
WSU	49	6	43	20	22	13%	87%	41%	46%
UWC	62	2	60	11	50	2%	98%	18%	80%
WITS	46	3	43	12	31	5%	95%	27%	67%
UZ	110	1	109	12	97	1%	99%	10%	88%
Total	**1,034**	**60**	**974**	**295**	**679**	**6%**	**94%**	**29%**	**66%**

Table 46: PGCE Year 4 outcomes by home language for the 2014 cohort

	Number enrolled	Did not graduate	Graduated	Graduated but did not join PERSAL	Graduate and joined PERSAL	Did not graduate	Graduated	Graduated but did not join PERSAL	Graduated and joined PERSAL
Afrikaans	242	11	231	129	102	5%	95%	53%	42%
English	130	6	123	65	58	5%	95%	50%	45%
IsiNdebele	2	-	2	-	2	0%	100%	0%	100%
IsiXhosa	138	12	125	40	85	9%	91%	29%	62%
IsiZulu	316	8	308	38	270	3%	97%	12%	85%
Sepedi	108	12	96	11	84	12%	88%	11%	78%
Sesotho	12	-	12	2	9	0%	100%	17%	83%
Setswana	37	6	31	3	29	15%	85%	7%	78%
SiSwati	4	1	3	-	3	25%	75%	0%	75%
Tshivenda	15	0	15	2	12	3%	97%	17%	80%
Xitsonga	16	1	15	2	14	6%	94%	9%	84%
Other	16	1	15	4	11	9%	91%	22%	69%
Total	**1,034**	**60**	**974**	**295**	**679**	**6%**	**94%**	**29%**	**66%**

3.5 Tracking the 2014 part-time PGCE cohort through university and into PERSAL

The flow-through rates for part-time PGCE students are slower than those of full-time PGCE students. Table 47 shows that 60 % of part-time PGCE students had completed their degrees by the end of Year 3, with no additional graduates in Year 4. Some 31% of those initially enrolled in part-time PGCE programmes were enrolled in PERSAL within four years. That is, only around half (52%) of graduates of part-time PGCE programmes went on to join the public schooling system within four years of enrolling.

Table 47: Proportions of part-time PGCE students who completed their studies and proportion that joined PERSAL by population group

	Year 1	Year 2	Year 3	Year 4	Number
Percentage who completed degree					
NWU	24%	56%	60%	60%	42
Unisa	26%	59%	69%	72%	844
Total	**24%**	**56%**	**60%**	**60**	**886**
Percentage who completed degree and joined PERSAL					
NWU	0%	11%	23%	39%	42
Unisa	0%	9%	24%	30%	844
Total	**0%**	**9%**	**24%**	**31%**	**886**

Conclusion

Using a unique data set created by merging information from matriculation examination data, HEMIS and PERSAL, this research study has revealed some important features of teacher supply in South Africa that were not possible to discern prior to this study:

- In particular, it is clear that there are large differentials in teacher flows through the university system, with part-time students and Unisa students performing particularly poorly.
- In addition, a large proportion of students do not enter PERSAL upon completion of their teaching studies. While this may sometimes be the result of them entering the South African schooling system in another way (e.g. as teachers in private schools or SGB teachers in public schools), these choices do not account for all of the slippage between student graduations and joining PERSAL. More information is needed regarding what happens to such graduates. In particular, it is necessary to find out whether or not they form an important part of the 'reserve teacher stock', teachers who join PERSAL but who have not been observed in HEMIS since 2010 and matric data since 2008.

PART 2: APPENDIX

Appendix Table 1: Age of teachers in PERSAL

Age (years)	Numbers					Percentages	
	2013	2014	2015	2016	2017	2013	2017
20	20	14	8	10	5	0.0	0.0
21	114	74	75	47	62	0.0	0.0
22	632	510	626	441	335	0.2	0.1
23	1,743	1,936	2,272	2,600	2,401	0.5	0.7
24	2,649	3,009	3,624	4,319	4,705	0.7	1.3
25	3,181	3,596	4,363	5,194	5,959	0.9	1.6
26	3,557	4,000	4,544	5,549	6,385	1.0	1.7
27	4,004	4,207	4,857	5,479	6,400	1.1	1.7
28	4,458	4,528	4,855	5,606	6,198	1.2	1.7
29	4,333	4,877	5,104	5,475	6,181	1.2	1.7
30	4,144	4,673	5,369	5,681	6,024	1.1	1.6
31	3,697	4,433	5,074	5,876	6,082	1.0	1.7
32	3,330	3,932	4,796	5,433	6,274	0.9	1.7
33	3,208	3,503	4,207	5,129	5,763	0.9	1.6
34	3,546	3,411	3,719	4,446	5,326	1.0	1.5
35	3,913	3,703	3,596	3,959	4,650	1.1	1.3
36	5,061	4,031	3,877	3,800	4,101	1.4	1.1
37	6,937	5,236	4,174	4,056	4,031	1.9	1.1
38	8,872	7,045	5,360	4,330	4,225	2.4	1.2
39	11,210	8,961	7,085	5,533	4,473	3.0	1.2
40	13,075	11,251	9,024	7,248	5,712	3.5	1.6
41	16,323	13,100	11,289	9,148	7,339	4.4	2.0
42	16,130	16,269	13,048	11,365	9,226	4.4	2.5
43	18,513	16,063	16,221	13,095	11,424	5.0	3.1
44	18,159	18,369	15,850	16,203	13,098	4.9	3.6
45	19,688	18,029	18,125	15,872	16,227	5.3	4.4
46	18,126	19,538	17,692	18,102	15,839	4.9	4.3

Age (years)	Numbers					Percentages	
	2013	2014	2015	2016	2017	2013	2017
47	17,916	17,929	19,080	17,657	18,071	4.8	4.9
48	16,900	17,693	17,474	18,922	17,622	4.6	4.8
49	16,117	16,686	17,233	17,326	18,845	4.4	5.1
50	14,921	15,789	16,189,	17,011	17,229	4.0	4.7
51	14,034	14,681	15,268	16,016	16,849	3.8	4.6
52	12,170	13,769	14,123	15,029	15,883	3.3	4.3
53	12,764	11,879	13,215	13,894	14,838	3.5	4.0
54	11,770	12,507	11,405	12,931	13,699	3.2	3.7
55	11,493	11,281	11,624	10,876	12,477	3.1	3.4
56	9,466	10,753	10,308	10,840	10,328	2.6	2.8
57	8,910	9,020	9,791	9,738	10,389	2.4	2.8
58	7,178	8,413	8,063	9,093	9,146	1.9	2.5
59	6,306	6,710	7,445	7,362	8,477	1.7	2.3
60	4,163	4,911	4,619	5,305	5,502	1.1	1.5
61	2,729	2,809	2,898	2,876	3,371	0.7	0.9
62	1,714	2,195	2,064	2,288	2,320	0.5	0.6
63	1,454	1,436	1,675	1,645	1,884	0.4	0.5
64	913	1,214	1,118	1,345	1,329	0.2	0.4
65	252	279	337	324	352	0.1	0.1
66	11	11	19	19	11	0.0	0.0
67	8	5	7	9	8	0.0	0.0
68	9	5	6	2	9	0.0	0.0
69	4	4	0	2	0	0.0	0.0
70	2	0	4	0	2	0.0	0.0
70	3	1	4	1	3	0.0	0.0
71	0	0	0	1	1	0.0	0.0
72	0	4	1	0	0	0.0	0.0
73	1	0	3	1	0	0.0	0.0
74	1	0	0	1	1	0.0	0.0
74	3	15	10	15	16	0.0	0.0
75	0	14	9	8	11	0.0	0.0
Total	**369,835**	**368,311**	**362,826**	**364,533**	**367,118**	**100.0**	**100.0**

Appendix Table 2: Teachers transitioning between 2013 and 2017 by school type

	2013	2017	Enter	Exit	Gap	% Enter	% Exit	% Gap
Primary	198,683	199,126	63,286	62,843	443	32%	32%	0%
Secondary	138,676	138,544	44,900	45,032	-132	32%	32%	0%
Combined	23,034	20,717	3,979	6 296	-2,317	17%	27%	-10%
Intermediate	9, 434	8,693	2,410	3,151	-741	26%	33%	-8%
Total	**369,827**	**367,080**	**114,575**	**117,322**	**-2,747**	**31%**	**32%**	**-1%**

Appendix Table 3: Teachers transitioning between 2013 and 2017 by age

Age in years	2013	2017	Enter	Exit	% Enter	% Exit	% Gap	Remain
19	1	-1	1	3				1
20	25	24	5	6	20%	24%	-4%	14
21	176	212	62	26	35%	15%	20%	88
22	967	1,148	335	154	35%	16%	19%	478
23	4,143	6,133	2,400	410	58%	10%	48%	1,333
24	7,340	11,387	4,691	644	64%	9%	55%	2,005
25	9,052	14,187	5,871	736	65%	8%	57%	2,445
26	9,464	14,464	5,907	907	62%	10%	53%	2,650
27	9,071	13,186	5,067	952	56%	10%	45%	3,052
28	8,651	11,780	4,193	1,064	48%	12%	36%	3,394
29	8,069	10,755	3,736	1,050	46%	13%	33%	3,283
30	7,518	9,873	3,374	1,019	45%	14%	31%	3,125
31	6,727	8,853	3,030	904	45%	13%	32%	2,793
32	6,210	8,245	2,880	845	46%	14%	33%	2,485
33	5,688	7,379	2,480	789	44%	14%	30%	2,419
34	5,747	7,037	2,201	911	38%	16%	22%	2,635
35	5,770	6,615	1,857	1,012	32%	18%	15%	2,901
36	6,677	7,097	1,616	1,196	24%	18%	6%	3,865
37	8,549	8,331	1,612	1,830	19%	21%	-3%	5,107
38	10,462	9,857	1,590	2,195	15%	21%	-6%	6,677
39	12,782	11,565	1,572	2,789	12%	22%	-10%	8,421
40	14,922	13,697	1,847	3,072	12%	21%	-8%	10,003
41	18,555	16,786	2,232	4,001	12%	22%	-10%	12,322
42	18,679	17,223	2,549	4,005	14%	21%	-8%	12,125
43	21,516	19,608	3,003	4,911	14%	23%	-9%	13,602

Age in years	2013	2017	Enter	Exit	% Enter	% Exit	% Gap	Remain
44	21,254	19,716	3,095	4,633	15%	22%	-7%	13,526
45	23,593	22,338	3,905	5,160	17%	22%	-5%	14,528
46	21,840	20,946	3,714	4,608	17%	21%	-4%	13,518
47	22,385	22,177	4,469	4,677	20%	21%	-1%	13,239
48	20,996	20,704	4,096	4,388	20%	21%	-1%	12,512
49	20,434	20,521	4,317	4,230	21%	21%	0%	11,887
50	18,632	18,245	3,711	4,098	20%	22%	-2%	10,823
51	17,644	17,551	3,610	3,703	20%	21%	-1%	10,331
52	15,541	15,373	3,371	3,539	22%	23%	-1%	8,631
53	15,715	14,497	2,951	4,169	19%	27%	-8%	8,595
54	14,646	13,590	2,876	3,932	20%	27%	-7%	7,838
55	13,639	11,510	2,146	4,275	16%	31%	-16%	7,218
56	11,163	8,139	1,697	4,721	15%	42%	-27%	4,745
57	10,704	6,455	1,794	6,043	17%	56%	-40%	2,867
58	8,486	4,594	1,308	5,200	15%	61%	-46%	1,978
59	7,565	4,089	1,259	4,735	17%	63%	-46%	1,571
60	4,920	2,674	757	3,003	15%	61%	-46%	1,160
61	3,233	1,304	504	2,433	16%	75%	-60%	296
62	2,056	691	342	1,707	17%	83%	-66%	7
63	1,767	630	313	1,450	18%	82%	-64%	4
64	1,082	344	169	907	16%	84%	-68%	6
65	308	112	56	252	18%	82%	-64%	0
66	32	25	4	11	13%	34%	-22%	0
67	18	14	4	8	22%	44%	-22%	0
68	8	2	3	9	38%	113%	-75%	0
69	5	1	0	4	0%	80%	-80%	0
70	4	5	2	1	50%	25%	25%	1
71	2	2	1	1	50%	50%	0%	0
73	1	1	0	0	0%	0%	0%	1
74	1	0	0	1	0%	100%	-100%	0
Total	**369,834**	**367,090**	**114,585**	**117,329**	**31%**	**32%**	**-1%**	**252,505**

Appendix Table 4: PGCE outcomes for the 2014 cohort by population group and year

Population group	% completed PGCE				% completed PGCE and joined PERSAL				Enrolled
	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4	
Black	88%	92%	93%	93%	0%	48%	72%	75%	669
Coloured	96%	97%	97%	97%	0%	48%	69%	71%	91
Indian	88%	92%	92%	92%	0%	14%	36%	41%	30
White	93%	95%	95%	95%	0%	17%	26%	29%	245
Total	**90%**	**93%**	**94%**	**94%**	**0%**	**40%**	**59%**	**63%**	**1,034**

Appendix Table 5: PGCE outcomes for the 2014 cohort by university and year

Population group	% completed PGCE				% completed PGCE and joined PERSAL				Enrolled
	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4	
CUT	78%	85%	86%	86%	0%	45%	66%	68%	100
UFH	81%	88%	90%	91%	0%	35%	61%	65%	40
UJ	86%	91%	91%	91%	0%	33%	56%	60%	29
UKZN	94%	96%	97%	97%	0%	45%	70%	74%	231
UL	89%	89%	89%	89%	0%	53%	81%	84%	29
NMMU	93%	94%	94%	94%	0%	26%	42%	44%	36
NWU	86%	91%	93%	93%	0%	33%	45%	48%	174
US	97%	97%	97%	97%	0%	22%	31%	33%	115
UNIVEN	100%	100%	100%	100%	0%	48%	76%	83%	15
WSU	69%	86%	87%	87%	0%	26%	46%	46%	49
UWC	97%	98%	98%	98%	0%	53%	75%	77%	62
WITS	93%	95%	95%	95%	0%	53%	65%	66%	46
UZ	95%	97%	99%	99%	0%	49%	76%	82%	111
Total	**90%**	**93%**	**94%**	**94%**	**0%**	**39%**	**59%**	**63%**	**1,035**

Appendix Table 6: PGCE outcomes for the 2014 cohort by home language and year

Population group	% completed PGCE				% completed PGCE and joined PERSAL				Enrolled
	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4	
Afrikaans	93%	95%	95%	95%	0%	45%	66%	71%	242
English	93%	95%	95%	95%	0%	35%	61%	69%	130
IsiNdebele	100%	100%	100%	100%	0%	33%	56%	63%	2
IsiXhosa	80%	89%	90%	91%	0%	45%	70%	78%	138
IsiZulu	94%	96%	97%	97%	0%	53%	81%	88%	316
Sepedi	83%	88%	88%	88%	0%	26%	42%	47%	108
Sesotho	96%	100%	100%	100%	0%	33%	45%	51%	12
Setswana	81%	85%	85%	85%	0%	22%	31%	34%	37
SiSwati	75%	75%	75%	75%	0%	48%	76%	90%	4
Tshivenda	97%	97%	97%	97%	0%	26%	46%	46%	15
Xitsonga	91%	94%	94%	94%	0%	53%	75%	80%	16
Unknown	78%	88%	91%	91%	0%	53%	65%	67%	16
Total	**90%**	**93%**	**94%**	**94%**	**0%**	**49%**	**76%**	**88%**	**1,035**

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PART 3:

MATCHING THE SUPPLY AND DEMAND OF TEACHERS IN SOUTH AFRICA

Servaas van der Berg
Martin Gustafsson
Cobus Burger

1 Background: current matching of supply and demand

As shown in Part 2 of this report, the current demand for new teachers every year is approximately 26,000, as derived from the number of new teachers that have to be appointed to replace those who have retired or who have exited the system, as well as to fill new positions, where these may have been created. It was also shown that this demand is indeed matched by the supply every year, at least at an aggregate level. However, about one-quarter of this annual supply of new teachers is the result of an inflow of mainly older teachers and not the result of the recent production of teachers within the university system. In projecting the demand and supply of teachers, it is essential to take cognisance of this currently relatively large source of the supply of new teachers, the 'reserve teacher stock'.

1.1 What is the source of the 'reserve teacher stock'?

The teachers joining the Personnel Administration and Salary System (PERSAL) in 2017 that were not observed in the other datasets available in this project (matric datasets from 2008 to 2017, HEMIS data from 2009 to 2017, and older PERSAL data from 2013) could be from a few possible sources:

- They could have been from older cohorts that studied at universities or even teacher colleges before 2009. This appears quite possible for most of them, as 90% are at least 30 years old.
- If so, they could have obtained their qualifications and not entered teaching previously but were now doing so after many years. As Part 1 of the report on Teacher Supply showed, many who study teaching do not start teaching soon thereafter. Some may do so later.
- More likely is that most are former teachers who have left teaching for some reason (among women, this may often have to do with having children and child rearing) and have now returned to teaching.

It is less clear who the younger members of this group of new joiners are. In 2017, 589 were aged less than 30 years. For such teachers, it would have not been possible to have studied at universities before 2009, the first year for which HEMIS data was available. This would mean that if they have university or equivalent qualifications, they must have obtained these outside South Africa.

- This could include South Africans who had studied abroad and were returning to teach, although the numbers of these in teaching are probably small.
- It could also include non-South Africans.
- It is possible that some of the teachers in this category (joiners in 2017, below the age of 30, not observed in PERSAL in 2013 to 2016, nor in HEMIS since 2009, nor in matric in 2008 or since) could have been misclassified because of administrative errors. Matching across the data sets may have been faulty in some cases, e.g. when identity numbers are mis-entered. There could also have been some errors with the recording of birth years.

The fact that there is a very good correlation between the rates of exits and of entry by language group over the period 2013-17 supports the impression that many of these teachers could have been returnees, teachers who had been in PERSAL and were then returning to teaching in the public service, or students who had not entered teaching after completion of their studies but were starting to teach for the first time later in life.

1.2 What can be expected in terms of the 'reserve teacher stock' in future?

As the source of this 'reserve teacher stock' is not quite clear, and as there is no guarantee that it will be replenished after a period of rapid expansion of teacher employment, it is best to be cautious in expecting too much from such a source. A conservative estimate of around 6,000 such teachers joining per year, which probably already allows for a modest inflow of foreign teachers, may be justified. But it is clear that planning teacher supply cannot depend too much on the availability of a 'reserve stock'.

2 Policies to expand teacher supply to meet the rising demand

2.1 Teacher production by universities

Currently, South African universities produce enough teachers annually to meet around two-thirds of the annual demand for new teachers in public service, as well as the annual demand for teachers in private schools and teachers in public schools paid by the school governing bodies (SGBs). Together, these latter two sources employ about 17% of all teachers, with the public service employing 83%. The annual production of new graduates from the universities rose quite sharply to over 28,000 in 2018, but only about 19,000 end up in the public service, i.e. they are captured in PERSAL. If the annual demand for new teachers outside the public service is approximately 15% of the total32, that implies that around 4,000 persons qualifying each year as teachers may never enter teaching in the public education system.

The big challenge in meeting the expanded demand for teachers is the lag between enrolment of prospective teachers in the university system until they obtain their qualifications and are potentially ready to enter teaching. An almost immediate expansion of enrolments in teaching qualifications is required, at least for the graduate (BEd) teaching degree. The number of those with Post-graduate Certificate in Education (PGCEs) may be easier to expand.

To increase graduate teacher supply from the university system will require both that universities expand their capacity to train teachers, and that there is effective demand to enrol in such courses.

With regard to enrolment in courses leading to teaching qualifications, it is unclear to what extent this could be expanded. Bursary schemes such as Funza Lushaka might help, but still do not guarantee that enough students will eventually graduate and then remain in teaching. This is even more pertinent now that National Student Financial Aid Scheme (NSFAS) bursaries are potentially available to more students, detracting from the relative attractiveness of teaching bursaries. Linking teaching bursaries to conditionality (i.e. that recipients undertake to teach for a number of years after graduating) is therefore even likely to make such bursaries less attractive.

The worsening economic situation owing to the world economic recession induced by the COVID-19 pandemic is likely to lead to higher levels of unemployment throughout the economy, inter alia amongst graduates. This may make it more attractive to enter teaching than might otherwise have been the case, as guaranteed employment after graduation becomes more attractive to students.

32 This assumes that the age structure and the attrition rates in these other teaching positions are broadly similar to that in the public service. This may not be true, but because of the public service's dominant share of the overall teacher demand, ignoring possible deviations in the growth of demand in other sectors will not greatly affect the overall picture.

It will be difficult to expand the capacity of universities to enrol more students in teaching training courses and to ensure that more students graduate, even if there are sufficient numbers of students desiring to become teachers. This will require an increase in staff in education faculties, yet the likelihood is that there will have to be a subsequent reduction in staffing when the new demand for teachers declines again after reaching its peak around 2030. The greatest capacity constraints will also be in the practical training of teachers, which is much more difficult to expand.

Using the numbers for the BAU scenario, which allows for a moderate reduction in the learner-educator (LE) ratio, and even when not allowing for such a reduction, graduate teacher production will have to expand drastically to meet the shortfall, as can be seen in Table 48. Even allowing for continuation of the pattern whereby some 7,000 positions are filled annually by 'reserve stock', perhaps returning teachers, residual demand which has to be met will more than double between 2019 and 2030. In fact, even by 2025, far larger numbers will be required annually (around 15,000 more than are currently made available each year). After 2030 there will be an almost equally sharp decline in the demand for new teachers. If there is over-production in this period, there may be scope for reducing the number of positions offered to returning teachers.

Table 48: Demand for new teachers in Grades 1 to 12, current and projected

Business as usual (BAU), assuming LE ratio improved	New public service demand	New demand outside public service	Total demand for new teachers	Assumed demand met by employing returning teachers	Total demand for new teachers after considering returning teachers
2019	26,000	5,500	31,500	7,000	24,500
2025	41,000	5,500	46,500	7,000	39,500
2030	50,500	8,500	59,000	7,000	52,000
2035	40,000	10,500	50,500	7,000	43,500
2040	28,500	8,000	36,500	7,000	29,500
2045	23,500	6,000	29,500	7,000	22,500
2050	23,000	5,000	28,000	7,000	21,000
Assuming unchanged LE ratio					
2019	23,500	5,000	28,500	7,000	21,500
2025	36,000	7,500	43,500	7,000	36,500
2030	42,500	8,500	51,000	7,000	44,000
2035	36,500	7,500	44,000	7,000	37,000
2040	25,500	5,500	31,000	7,000	24,000
2045	22,000	4,500	26,500	7,000	19,500
2050	20,500	4,000	24,500	7,000	17,500

2.2 Encourage enrolment shifts from part-time to full-time

As was shown in Part 1 of the report on the supply of teachers, a very large proportion of teachers are enrolled in part-time courses. One consequence is that many of these students take a long time to graduate, if they graduate at all. Moreover, perhaps because many such students are employed part-time whilst studying, they may become committed to alternative careers by the time they approach graduation. This may be a factor accounting for why many who do eventually graduate do not end up in public service teaching positions. The degrees they obtain may nevertheless be of some value to them in other fields, as employers may focus more on whether or not a potential job applicant has a degree than on the relevance of the degree to the particular position.

To illustrate the difference: in their fifth year after enrolling for a BEd, 69% of full-time candidates graduate, while only 30% of part-time candidates do so. In the sixth year after enrolling, this difference is 73%, compared with 40%.

2.3 Entice more teacher graduates to actually enter teaching

As has already been shown, a substantial number of teachers who qualify every year do not enter the teaching profession. This applies not only to PERSAL, since the number of newly qualified teachers who do not enter PERSAL is still greater than the estimated annual uptake of positions in private schools, SGB positions and positions in special needs education. It is possible that a tighter job market because of an economically difficult period may make teaching a more attractive proposition, in which case some of this shift may happen automatically as teaching's relative attractiveness improves.

2.4 Postpone teacher retirement

Internationally, there has been strong pressure in developed and even some developing countries to raise the retirement age. The reason for that lies in the fact that improved health has increased life expectancy, placing retirement systems under pressure due to the increased number of years that people live on average after retirement. The ability of pension schemes, particularly pay-as-you-go pension schemes, to offer attractive retirement income is declining. Even in funded retirement schemes, as is common in South Africa, pensioners are increasingly concerned about the adequacy of their retirement provision.

In such circumstances, some employees may be attracted to schemes whereby they can supplement their retirement income and reduce the period of retirement by working till an older age. This can be encouraged amongst teachers paid by the public sector by offering more teachers contracts to teach for a few years longer. If such contracts are made attractive enough, they may assist in postponing retirement for some teachers, thereby reducing teacher attrition, which may be of considerable value in flattening the curve of the demand that has to be met by raising production of teacher graduates.

2.5 Attract graduates without a teaching qualification into teaching

Currently, first-time graduates with bachelor's degrees other than in teaching need to enrol for an additional year of study to obtain a PGCE if they wish to enter teaching. For some who are still considering their career choice, this may be a disincentive to consider teaching rather than another career, given the additional cost of studying and the additional year that they would not be earning a salary. Offering alternative routes to entering teaching while also obtaining a teaching qualification may attract more people into teaching. This would be true even more if graduate unemployment rises as a result of the economic impact of the COVID-19-driven world recession. An alternative, for instance, might be to offer

the possibility of a short introduction to teaching course before starting to teach, with subsequent part-time studies to complete a PGCE, perhaps tailored a little differently to the specific needs of teachers entering the profession via such a route.

2.6 Appoint more foreign teachers

One possible way of expanding domestic teacher supply would be to import teachers from other countries. The advantage of such an approach is that teachers could be imported for limited contract periods to assist in the period when the annual supply of new teachers produced by the university system is under strain, and such contracts could be planned to run out in the subsequent period, when the need for new teachers to join the public service is reduced. In terms of importing teachers, two sets of countries could be considered: firstly, South Africa's neighbours, and then countries further afield, with India in particular often mentioned as a source of such potential supply.

At least three Southern African countries (Botswana, Lesotho and Zimbabwe) have an over-supply of teachers who cannot find teaching jobs. However, the first two countries are small in terms of their population, and so their excess supply of teachers will not contribute greatly to expanding teacher supply in South Africa, even if their teachers were permitted to teach here. The situation in Zimbabwe is somewhat different: having a much larger population, the number of teachers potentially available for South Africa to import is commensurately greater. The extremely weak state of the Zimbabwean economy will make it quite attractive for many teachers from that country to apply for jobs in South Africa. The potential outflow may, however, affect Zimbabwe's ability to retain enough teachers in its own school system. This could become a source of political tension unless there is an agreement between the governments of the two countries regarding how many Zimbabwean teachers would be permitted to be recruited annually to work in South Africa's public schools. Similar agreements could also be entered into between the governments of South Africa and Botswana, and South Africa and Lesotho.

Importing teachers from India has long been suggested as a possible solution to meeting the demand for teachers in South Africa. This is something that could be considered. Given the size of India's population, the number of Indian teachers available for such positions is quite large, and could potentially swell the ranks of teachers available to meet the expanding demand that South Africa will be experiencing in the next few years. Teacher salaries in South Africa are likely to be attractive to teachers from India (many low-cost private schools in India have been made possible by a glut of potential teachers). Considering countries other than India as possible source countries may well be viable for some teaching positions, although clearly not those which require a language other than English.

3 Conclusion

Meeting the demand for public sector teachers that is currently increasing so rapidly will be extremely difficult. It is likely that a teacher shortage may further postpone a reduction in learner-educator (LE) ratios, simply because of the great deal of effort and substantial fiscal resources required to meet the demand for teachers through increased production of qualified teachers by the universities. Alternative measures mentioned could help flatten the curve. While the economic impact of the current pandemic is likely to be severe and to constrain fiscal resources even more, the pandemic may in some way make earning a steady salary in teaching more attractive than may have been the case otherwise. Nevertheless, it will take considerable effort for the school system to surmount the severe challenge of teacher supply that the school system is faced with.

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Servaas van der Berg
Martin Gustafsson
Cobus Burger

Research on Socio-Economic Policy (ReSEP)

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